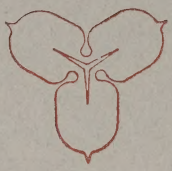
DEPARTMENT OF
SCIENTIFIC AND INDUSTRIAL RESEARCH
NEW ZEALAND



BOTANY DIVISION

1982-84

TRIENNIAL REPORT

DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH

Triennial Report of Botany Division

Christchurch - New Zealand

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INTRODUCTION

(W. Harris)

This ninth Triennial Report of Botany Division of the Department of Scientific and Industrial Research records progress of work and significant developments in the years 1982 to 1984. The triennium was marked by the contrasting demands on Botany Division for effort towards conservation of natural botanical values in New Zealand and the direction of botanical knowledge to further plant production for economic purposes. The objective and functions of Botany Division have allowed a response to both sets of demands, effectively using facilities, expertise and knowledge developed by long-term planning and research programmes. Botany Division has endeavoured, in spite of external constraints, to continue botanical research of the highest standard, and to transfer the information gained from this research in a responsible and impartial way to a diverse clientele.

OBJECTIVE AND FUNCTIONS

During the triennium the previously-stated objective and functions were reviewed and revised.

Objective

To undertake botanical investigation, disseminate botanical information, and apply botanical knowledge for the benefit of New Zealand.

Functions

1. To describe, classify, and name the native, naturalised and horticultural flora of New Zealand and the South Pacific Islands.
2. To describe and classify the plant communities of New Zealand.
3. To investigate biological processes in the vegetation and plants of New Zealand.
4. To investigate the history of the vegetation of New Zealand in relation to past climatic, geological and cultural events.
5. To evaluate the effects of primary production, industrial and urban developments on the botanical environment.
6. To determine and conserve the biological resource of the New Zealand Flora.

STAFF

The period under review was marked by several significant retirements and a large number of temporary appointments, mostly through government employment schemes.

Introducing the eighth Triennial Report, Dr H.E. Connor noted the approaching retirement of Dr E.J. Godley and referred to the appropriateness of honouring his service to Botany Division at that time. In May 1984 a symposium on Research on the Vegetation of New Zealand was held at the Ellesmere Country Club, Lincoln, to honour his contribution to botanical research in New Zealand and to the Department of Scientific and Industrial Research. He provided leadership as a Director for 27 years,

first for Crop Research Division, and then for twenty-two years for Botany Division. In the final four years of his service, Eric Godley was able to devote more time to research, but he also continued to serve administratively as Chairman of the DSIR Lincoln Centre.

Dr H.E. Connor retired in August 1982. This completed continuous service with Botany Division from 1941, culminating in his appointment as Director in March 1980. Henry Connor was the first recipient of the Allan Mere presented for meritorious service to Botany Division. The Mere, donated by Dr Lucy B. Moore on 27 April, 1982, commemorates the 100th anniversary of the birth of Dr H.H. Allan, first Director of Botany Division. Other recipients of the Allan Mere in the triennium were Mr A.P. Druce, Mrs B.V. Paterson and Dr E.J. Godley.

Mr A.P. Druce retired in December 1982 completing service with Botany Division in the period 1947-54 and from 1958 when he worked from the Taita Substation of Botany Division. As with Eric Godley and Henry Connor, Tony Druce continues a close working association with Botany Division in his retirement. Details of the valued service given by Dr Godley, Dr Connor and Mr Druce are given later in the Report.

Dr D.J. Galloway, a scientist with Botany Division since December 1972, resigned in March 1982 to take up a position with the Natural History Department of the British Museum, London. After his resignations he continued work on the lichen volume of the Flora of New Zealand which was completed during the triennium in readiness for publication in 1985. Mrs B.V. Paterson, Administration Officer from January 1980, resigned in November 1984, Mr R.W.J. Knox, Librarian from October 1980, resigned in June 1984, and Miss R.H. Conway, Botanical Artist from December 1979, resigned in April 1983.

Dr Warwick Harris, from Grasslands Division, Department of Scientific and Industrial Research, Palmerston North, succeeded Dr Connor as Director in August 1982.

The Nelson Regional Station of Botany Division was closed early in 1982, with the consequent transfer of Mr G.Y. Walls to Lincoln and the appointment of Dr N.M.U. Clunie to establish the Botany Division Regional Station at Kaikohe. During the period of the Report arrangements were made for the reopening of the Nelson Regional Station by the transfer of Dr P.A. Williams from Lincoln to Nelson late in 1984, and for the opening of a Regional Station in Havelock North in 1985 by Mr G.Y. Walls. Dr C.D. Meurk, a graduate of Otago University and for a period employed as a scientist at Grasslands Division Regional Station, Gore, was appointed in November 1984 as scientist with responsibility for research on indigenous grasslands.

Dr P.J. Garnock-Jones completed a DSIR Study Award at the Botany Department, University of Reading, England in November 1982. Dr W.G. Lee commenced a DSIR study award at the Botany School, Cambridge University, England in April 1984 relating to the ecology of shrub species. Dr A.J. Fife commenced as a National Research Advisory Council Fellow in September 1982 to work on the Moss Flora of New Zealand.

Overseas visitors who based themselves at Botany Division for extended stays were Professor Bert G. Brehm, Reed College, Oregon, USA, particularly to study Umbelliferae, and Professor Arne Strid, University

of Copenhagen, Denmark, who visited many alpine regions and made plant collections in extension of his authoritative knowledge of European mountain floras and the taxonomy of Ranunculaceae and Cyperaceae.

The work of Botany Division was particularly advanced by the efforts of 29 persons engaged through the Project Employment Programme. Many of these people were highly skilled and trained, both botanically and otherwise. The scheme allowed these skills to be effectively used to the advantage of Botany Division. The Special Employment Scheme, although specifically directed to the Department of Lands and Survey and NZ Forest Service, also heavily involved Botany Division staff both in supervisory roles and in co-operative work with botanically qualified persons employed under the Scheme. In providing vacation work for University students, Botany Division has further advanced research programmes and provided relevant work experience.

Three contracts were established with the Noxious Plants Council in 1984. Miss L.J. Mather commenced a one-year contract to study *Erica lusitanica,* and Miss C.J. West and Mr N.J. Taylor commenced three-year contracts to study *Clematis vitalba* and *Stipa trichotoma* (nassella tussock) respectively. Through a grant from the New Zealand Lottery Board, Miss C.M. Brown was engaged in October 1984 to prepare a Guide to Threatened Plants of New Zealand. Temporary appointments of Mr H.D. Wilson and Mrs B.R. Clarkson considerably advanced progress towards obtaining descriptions of vegetation for Stewart Island and the western part of the Gisborne Land District.

ADMINISTRATION

Development of the DSIR Lincoln Centre during the triennium required changes in the structure of administrative services to Botany Division. Establishment of a centralised administration office servicing Botany Division, Crop Research Division and regional groups of other divisions at Lincoln required dis-establishment of the position of Administration Officer, Botany Division, and changing this to the position of Finance and Planning Officer, DSIR, Lincoln. Under the new arrangement, Mr B.W. Stewart became Executive Officer, DSIR, Lincoln, Mr W.P. Mills became Centre Administration Officer and Mrs B.V. Paterson became Finance and Planning Officier. With the retirement of Dr Godley, the role of Centre Chairman was replaced by an annual rotation of the position between the Directors of Botany Division and Crop Research Division. Commencement of the joint Department of Scientific and Industrial Research and Ministry of Agriculture and Fisheries building programme at Lincoln in 1984 will require further administrative adjustments.

Regional Sections

With the strengthening of the network of Regional Botanists the appropriateness of North Island and South Island Ecology Sections was recognised. These sections were established in 1984 and placed under the leadership of Dr I.A.E. Atkinson and Dr P.A. Williams. Dr P. Wardle has responsibility for overall co-ordination of Botany Division's activity in plant ecology.

Extension

Miss S.J. Gamble was appointed as the first Advisory Officer for Botany Division in November 1983. This position responded to the increased demand on Botany Division for environmental comment and botanical information, allowed further extension of the services provided to the public and provided more efficient use of scientific expertise. Circulation of the *Botany Division Newsletter* has been widened, in response to demand, to persons and agencies with working contacts with Botany Division. Dr A.D. Thomson has produced 20 Newsletters and a supplement recording the 1983 Biennial Meeting during the triennium. Entering of the Botany Division Vegetation Report Series on the DSIR SIRIS system, preparation of display boards, and provision of information through semi-popular and popular articles to the Alpha Series, the *New Zealand Gardener,* and newspapers have fostered the transfer of botanical information for public use. Expertise of staff has continued to be in heavy demand through requests for public lectures and talks, service on boards and committees, and through individual client contact.

Buildings and Equipment

Requirement for the relocation of DSIR staff in Dunedin from rented accommodation in the Moray Street Post Office building led to commencement in 1984 of a building close to the University of Otago. The building, to be completed in 1985, will provide office and laboratory facilities specifically designed for the three Botany Division scientists located in Dunedin and for the Dunedin staff of Soil Bureau and Geological Survey.

Approval was gained and an order placed in 1984 for a Zeiss 902 transmission electron microscope to replace the ageing Hitachi HU-llB instrument installed in 1965. To obtain this expensive instrument, which has analytical capacity, agreement for shared use of the instrument was reached between several divisions of the Biological Industries Group of DSIR, the Ministry of Agriculture and Fisheries, and the Wool Research Organisation of New Zealand, located at Lincoln.

MEETINGS

The Seventh Biennial Meeting of Botany Division was held at Akatarawa, near Wellington, the first time the meeting has been held outside Canterbury. Compensating for the logistics of moving a greater number of staff to the North Island, the venue gave staff the opportunity to explore and apply their expertise to the vegetation and flora in a different part of New Zealand and to interact with staff of other DSIR divisions and organisations with interests in botany in Wellington. Associated with the Biennial Meeting was a meeting on palynology involving Geological Survey, and a workshop on scrub involving Ecology Division. A detailed account of the Biennial Meeting held in September 1983 is given in *Botany Division Newsletter Supplement No. 1,* February 1984.

DSIR-CSIRO Colloquium on Plant Taxonomy

Dr E. Edgar, Dr P.J. Garnock-Jones, Dr D.R. Given, Miss B.H. Macmillan, Dr B.P.J. Molloy, Mr W.R. Sykes and Dr C.J. Webb participated in a DSIR-CSIRO Colloquium on Plant Taxonomy, held in Canberra

between 16 September and 2 October 1983. An important purpose of the Colloquium was to ensure that plants common to New Zealand and Australia are identified accurately, as well as to determine which species have close trans-Tasman relatives. As this purpose was the idea of Dr H.E. Connor during his term as Director, it was fitting that he accompanied the Botany Division group that participated. The success of the Colloquium was due in large part to the initiative taken by Botany Division staff to develop the programme. A record of the Colloquium is provided by a special Botany Division report which has substance in respect to botanical information, and recommendations to maintain and develop further research on taxonomy of joint interest to Australian and New Zealand botanists.

Research on the Vegetation of New Zealand

The symposium on this topic, held on 1 and 2 May 1984, reviewed botanical research on the vegetation of New Zealand undertaken to the present with the purpose of considering priority areas of research for the future. Eight sessions covered biosystematics of higher and lower plants, plant form and function, vegetation history, demographic processes and environmental influences involved in present-day vegetation, and plant conservation. Keynote speakers were Dr E.J. Godley, Dr H.E. Connor, Dr A.J. Fife, Dr M.J. Parsons, Dr P.J. Brownsey, Dr W.H. Lintott, Dr D.G. Lloyd, Dr M.S. McGlone, Dr J. Ogden, Dr P. Wardle and Professor A.F. Mark. Extended periods for discussion led by invited chairpersons and panellists allowed effective participation by many of the people who have made significant contributions to botanical research in New Zealand in recent decades. Publication of the keynote papers in Part 4 of Volume 23 of the *New Zealand Journal of Botany* will provide a record of the proceedings of a well attended, successful meeting, and fittingly record the part played by Eric Godley in the establishment of the *New Zealand Journal of Botany*.

A record of the discussions of the symposium will be provided in a supplement to the *Botany Division Newsletter*.

RESEARCH PROGRAMMES

A comprehensive listing of projects currently undertaken by Botany Division was completed in June 1983, itemising 263 projects under ten major headings. Preparation of a DSIR strategic statement in 1984 required the description of Botany Division's work as two major programmes: Biosystematics of the Flora and Plant Ecology and Vegetation Survey. Details of work undertaken as part of these programmes are given in this Report.

Sound progress was made on the Flora series with completion of the text for the Lichen Flora, preparation to an advanced stage for the Flora for naturalised dicotyledons, gymnosperms and ferns, and continued intensive effort on the Grass Flora. Botany Division also undertook to include in the Flora Series a three volume Desmid Flora in preparation by Dr Hannah Croasdale, Dartmouth College, New Hampshire, USA and Dr Elizabeth Flint, Christchurch.

Major effort within the Plant Ecology Programme has continued to be directed towards the Biological Survey of Scenic Reserves by contract with the Department of Lands and Survey. Descriptions of the Scenic Reserves of Southern Marlborough and of the Marlborough Sounds were published

under the authorship of Dr P.A. Williams and Mr G.Y. Walls respectively. Location of regional botanists in Kaikohe and Rotorua allowed early progress in the survey in the northern and central regions of the North Island. Staff of the Ecology Sections contributed significantly to the definition of Ecological Regions and Districts for New Zealand and were active in surveys undertaken as part of the Protected Natural Areas Programme. An important initiative taken was survey towards an inventory of New Zealand Dune and Beach Vegetation. Staff of the Ecology Sections have had heavy commitments reporting on environmental impacts and contributing to management plans for areas including native vegetation.

Support of the specialist disciplines of palynology, cytology, plant morphology and anatomy and seed studies by Botany Division has continued, for the greater part, at minimal levels. Progress in these disciplines has been directed through the long-term objectives of Atlases for seed, pollen, wood anatomy and chromosomes. There is continuing demand for information and expertise from these disciplines both from taxonomists and ecologists in Botany Division and from outside clients in forensics, geology, archaeology, climatology and agriculture. It is a matter of concern that financial and staff number constraints and pending retirements may not allow Botany Division to continue support of all of these specialist disciplines in future.

THE HERBARIUM

International Code, CHR
(Herbarium Keeper Dr D.R. Given)
(Assistant Keeper Miss B.H. Macmillan)

Additions to the herbarium files are maintained at about 10,000 specimens annually. The emphasis on naturalised dicotyledons and grasses reflects the revisionary work being done by the taxonomists. Twenty bench-height steel cabinets were purchased, this time painted red in contrast to the blue-grey of our cabinets up till then. Less than half of the grass specimens are housed in these red cabinets.

SPECIAL EMPLOYMENT PROJECT

With the help of Project Employment Programme workers the grass collection has been largely curated. Under Dr E. Edgar's supervision the mounting and labels of older specimens have been brought up to modern standards, so greatly enhancing their usefulness. Temporary assistance has also been valuable for mounting and cataloguing the large Tongan collection of G. Buelow and the Cook Islands specimens of W.R. Sykes. The Chatham Island collections of G.N. Park and G.Y. Walls (1980), and D.R. Given and P.A. Williams (1982) were incorporated. A.W. Purdie prepared a large number of specimens of *Carmichaelia*. Some larger rearrangements of specimens have been: Rosaceae genera after J. Hutchinson "The Genera of Flowering Plants", 1964; Podocarpaceae after C.J. Quinn *Aust. J. Bot.*

30: 311-320, 1982; Eucalyptus after M.D. Wilcox "A Catalogue of the Eucalypts", 1982 based on L.D. Pryor and L.A.S. Johnson, "A Classification of the Eucalypts", 1971.

Our "Herbarium Principles and Users' Guide" was rewritten as a Botany Division unpublished report in 1983 and incorporates changes in procedure following the introduction of computer-produced labels. Annual fumigation of the Herbarium with methyl bromide was commenced, and the freezing of incoming parcels and stored specimens was introduced as a routine method of insect control. Two herbarium curators in training, Miss E. Grant from Massey University, and Mr P. Champion from University of Waikato have visited to discuss techniques, resulting in a useful exchange of ideas. In 1984 the annual New Zealand Herbarium Keepers' Meeting was held at Botany Division, attended by 8 visiting keepers.

The Botany Division's specimens identification service is managed by the Herbarium staff, and 3646 requests were registered and handed to the appropriate staff member. This service has been a valuable source of weed records. There is an increasing use of the Herbarium by workers contracted to Lands and Survey Department and NZ Forest Service on district or ecological region floristic surveys, and some valuable specimens have been received from them.

In 1982 the late Dr J. Child of Dunedin gave to Botany Division his lichen collection of 2090 specimens; lichens of the mountains of Otago are especially well represented.

In June 1983 the Armstrong Herbarium of 2600 specimens was transferred to Botany Division from the Christchurch Botanic Gardens, on indefinite loan. J.A. and J.B. Armstrong settled in Christchurch in 1862 and commenced building a herbarium representative of the flora of Canterbury over three decades. It includes a number of type specimens and some cryptogams. The herbarium is kept as a separate collection. In the same month Dr Greta Stevenson gave to the Division her macrofungal specimens collected in New Zealand since 1970. They are stored in 30 boxes and are accompanied by a file cabinet of manuscript descriptions and water-colour illustrations.

We are grateful also to the following donors of specimens:

Dr B. Allen: Mosses of North America
Mr J.K. Bartlett: *Seligeria*
Dr J. Beever: Mosses of Little Barrier Island and North Auckland
Mr A.M. Buchanan: New Zealand alpines
Dr P.J. Brownsey: *Hypolepis lactea* isotype
Mr W.D. Burke: Nelson Lakes National Park
Mrs D.A. Cooper: *Pterostylis cardiostigma* holotype
Mr J.R. Croft: New Guinea ferns
Mr M. Daellenbach and A. Huber: Indian ferns
Drs I. and 0. Degener: Hawaii
Mr P. de Lange: Waikato region
Mr A.P. Druce: North Island mountains, Nelson and Marlborough
Dr J.A. Elix: Lichenes Australasici Exsiccati, *Parmelia*
Dr A.J. Fife: Mosses of Alaska
Dr H. Fritze: European grasses and sedges
Dr D.J. Galloway: *Pseudocyphellaria*

Dr P.J. Garnock-Jones: Spanish plants, especially Cruciferae
Dr W.M. Hamilton: *Dizygotheca elegantissima*
Mr A.J. Healy: Naturalised New Zealand, New South Wales
Dr A. Henssen: *Roccellinastrium neglectum* isotype
Dr J. Lewinsky: New Zealand mosses
Dr P.A. Maddison: Kiribati
Mr W. Makepeace: *Hieracium*
Dr H. Mayrhofer: *Rinodina* isotypes
Dr C.D. Meurk: Subantarctic Islands
Dr F. Michaelis: Aquatic bryophytes
Mr C.C. Ogle: Wildlife Service surveys
Mrs J.A. Petterson: *Wahlenbergia* specimens and papers
Mrs M.A. and Mr I.M. Ritchie: Nelson, Stewart Island
Dr W. Rossi: *Rhachomyces kenodactylii* isotype
Dr R.D. Seppelt: Antarctic lichens
Mr W. Shaw: Urewera National Park
Mr G. Stewart: *Frullania*
Dr A. Strid: Australian alpines
Dr L. Tibell: New Zealand lichens, Caliciales
Dr A. Whistler: Pacific Islands
Mr H.D. Wilson: Stewart Island cryptogams
Mr A.E. Wright: *Beilschmiedia tawaroa* isotype
Forest Research Institute: Mosses of Camp Creek, Westland

Duplicate specimens were exchanged with 60 herbaria of which 55 are overseas, in 20 countries. The larger consignments were received from:
Australia: State Herbarium, Adelaide; National Herbarium, CSIRO Canberra; Tasmanian Herbarium, Hobart
Denmark: University of Aarhus
Japan: Kobe-Gakuin University
Sweden: Swedish Museum of Natural History (lichens)
USA: Bishop Museum, Honolulu; Missouri Botanical Garden (especially woody flora of New Caledonia); North-east Louisiana State College; Ohio State University; Oregon State University; Smithsonian Institution; University of Vermont
USSR: Komarov Botanical Institute

In New Zealand, Auckland Institute and Museum, Botany Department, University of Auckland, and Forest Research Institute, Rotorua have sent specimens of naturalised plants, and National Museum, Wellington, has sent cryptogams.

More than 120 outward loans were handled, 65 to overseas herbaria. About 115 inward loans were chiefly concerned with the taxonomy of grasses, naturalised plants, and mosses.

Over 130 visitors worked in the herbarium and we are particularly grateful to Drs M. van Balgooy, F.R. Fosberg, D.G. Frodin, M. Hale, S. Jacobs, D. Mackenzie, T. Suzuki, M. Tindale, R. and A. Tryon, M.D. Wilcox and J.H. Willis for attention to specimens in their special areas of interest.

HERBARIUM ELECTRONIC DATA PROCESSING (Ms Janie Glasson)

Since the first account of electronic data processing in the Herbarium

contained in the 1979-81 Triennial Report, we have been primarily involved with an initial period of evaluation, development and streamlining of a workable system. We have steadily progressed through this developmental period and are directing our energies to the formation of a comprehensive and valuable data base.

To this end, with PEP assistance nearly 12,500 records have been processed onto the CHIRP data band and 20,000 mounted herbarium specimens standardized and checked ready for processing onto permanent storage. The inputting of new accessions takes the highest priority, as label generation is totally dependent on this resource. Therefore to maintain the flow-through system to the Herbarium and provide accessibility to these specimens there is need to keep abreast with this continual supply.

For implementation of this information in a convenient and accurate format CHIRP data standards have been devised along with a field form book system. The data standards are at present undergoing final evaluation and appraisal. The field form book system has been adopted by the majority of collectors, and has proved useful to the person inputting the data. It enables easy interpretation of information by providing a standardized yet flexible format.

Our present hardware consists of:- 1 Hewlett Packard 2645A terminal, 1 Hewlett Packard 9871A printer, 1 Digital VT220 terminal and intermittent use of a second Digital VT220 terminal. The Systems Manager and Program Developer is Bruce Muschamp (PEL) who has devised two similar programs to run on these terminals. The more recent program contains a time-saving editing program which is faster to run and has a mask format differing in its arrangement from the other.

A report entitled "EDP in the Botany Division Herbarium", by D.R. Given and J. Glasson outlines the concept, development, progress, problems and constraints of CHIRP. Detailed program documentation is in a series of reports by B.G. Muschamp.

Records contained on the data bank include specimens from the Otago Peninsula Survey, the rare and endangered plant list, Chatham Is, Stewart Is, Kermadec Id, North Auckland and Auckland collections, Nelson-Marlborough survey, Bay of Plenty, Antarctica and numerous other collections.

ALGAE (Dr M.J. Parsons)

Curation of the algal herbarium continues using a general classification based on T. Christensen (1980, "Algae, A Taxonomic Survey") with a few more recent modifications. Small sheets of older collections are being mounted on standard herbarium sheets and placed into light paper specimen folders. In August 1984, duplicates of marine benthic algae were sent out for exchange to twelve institutions and individuals. These are: ADU, GALW, L, LTB, MELU, NFLD, NU, SGO, SNU, SSUC, UC and M. Edding (Coquimbo, Chile).

THE LAING ALGAL HERBARIUM

On 6 July 1983 the R.M. Laing Algal Herbarium belonging to the Botany Department, University of Canterbury, Christchurch, was transferred to Botany Division on long-term loan. This important collection of about 6000 sheets of mainly marine benthic algae will remain as a separate collection

and is at present housed in 76 cardboard boxes. Fourteen boxes of microscope slides are also included in the collection but the notebooks, letters and unfinished manuscripts belonging to Mr Laing have been photocopied and the originals returned to the University of Canterbury for inclusion in the Laing collection of algal literature in the University library.

After R.M. Laing died (19 May 1941) his algal herbarium and literature was offered to the University of Canterbury but it was not until 1968 that any attempt was made to curate and mount these specimens on standard-sized sheets, which were then numbered sequentially. Much curation however still remains to be done. On 8 May 1968 the first loan of sheet numbers 1-48 of specimens collected by Laing from southern New Zealand and the Subantarctic Islands was sent to Dr Rene Delepine, Paris, France. The return of these important voucher specimens has been requested many times over the years; most recently on 23 August 1983, 31 August 1983 and 19 June 1984. At the time of writing, these specimens have not been returned to the Laing Herbarium.

BRYOPHYTES (Miss B.H. Macmillan and Dr A.J. Fife)

The mosses and hepatics at Botany Division are now estimated to total 85,000 packets (64,000 mosses and 21,000 hepatics) including the T.W.N. Beckett herbarium which is not incorporated in the files. The task of amalgamating indigenous and foreign specimens in one system after M.R. Crosby and R.E. Magill "A Dictionary of Mosses", 1978, is almost completed. Species are in alphabetical order with guide cards colour-coded for geographical regions. Temporary worker assistance has been valuable in packeting exchange material. Dr A.J. Fife has contributed about 2,600 New Zealand collections, and his work has allowed us to continue and open exchange with a total of 11 foreign herbaria. The large consignments have been received from University of Alberta, University of Michigan, Missouri Botanical Garden, and New York Botanical Garden, including specimens of very diverse geographical origins.

Dr Jessica Beever, working in association with the Botany Division Regional Station, Auckland, has contributed many collections and material for exchange from North Auckland and off-shore islands.

Part of the herbarium of R. Brown ter. was received with the Canterbury Museum herbarium in 1975. It includes types for 134 names published by Brown between 1893 and 1903. These are being curated and a list prepared for publication.

Following the death of Dr J. Child of Dunedin in November 1984, Botany Division received from his family his bryophyte herbarium consisting of 6,700 mosses and 5,600 hepatics, and dating from 1968.

THE LIBRARY

(Mrs L. Nesbitt)

With the resignation of Mr R.W.J. Knox, Librarian-in-Charge (22 June 1984), the library staff were under considerable pressure of work in the latter part of the Triennium. Useful assistance was provided by Project

Employment Programme workers, temporary employees and students on vacation.

The library continues to expand its substantial collection of floras. Extra funds have been sought from the Sub-Committee on Strengthening Resources of the New Zealand Library Resources Committee for microfiche items as important and costly as the New York Botanical Garden Vascular Plant Type Collection, the United States National Herbarium Vascular Plant Type Collection, the Willdenow Herbarium and Index and the Reichenbach Herbarium. Further applications will be made for the acquisition of major items of national importance.

Examination of inter-library lending figures showed the library to be a substantial net lender. Of items requested by staff, about 10% had to be obtained from outside New Zealand, mostly from Australia, Canada, USA and the United Kingdom. Library acquisitions for 1983 were about one half of those ordered in 1982, and there was a further reduction in the numbers of books ordered in 1984. This was mainly due to the increase in book costs, and devaluation of the New Zealand dollar.

Because of financial constraints, bookbinding is not keeping pace with the number of completed volumes in stock. Purchase of microform volumes of the more bulky journals is contemplated.

The library now has available a terminal capable of online searching through DIALOG and OASIS, which gives access to overseas databases. This facility is being used by all divisions. The library also has a terminal linked to the DSIR computer network, which can be used to access the DSIR Bibliographic Network. By using the ALICE (Automated Library Information Control & Exchange) system, 14 databases are available. The most important of these is LIBRA, which contains records for all new purchased items accessed by DSIR libraries since May 1983, an extensive amount of new material from January 1983, and a selection of older items. Others include FRESH, a freshwater bibliography of 10 000 records (a closed file, it is now updated by input to SIRIS); SIRIS, an index to New Zealand scientific and technical papers, reports and books, which had 5 000 records by August 1984; SOSRIS, an index to New Zealand social sciences information; COAST, a New Zealand coastal bibliography of 6 000 records (updated by SIRIS); BERRYFRUIT, which covers all types of berry fruit; and DINO, a thesaurus/SIRIS word list of 7,000 terms. There are also plans for the library to connect with the New Zealand Bibliographic Network. The library has a new terminal for the library work area which will be used specifically by library staff; this is awaiting installation by the Post Office.

In early 1982 the library received some new carpet and with a new inside coat of paint in early 1984, it now has a pleasing interior.

New shelving has been erected in the journal section. This allows for about five years' expansion before extensive rearrangement of existing shelving or rebuilding will be required. There is also new display shelving for the reading area which will allow the reduction of automatic circulation of journals to scientific staff and a great saving of time for the librarians.

EXPERIMENTAL GARDENS

(Mr I.C. Brown and Dr B.P.J. Molloy)

Location: 23 km southwest of Christchurch
Latitude: 43°38′ South Longitude: 172° 30′ East
Altitude: 11 m a.s.l. Topography: flat to undulating
Soils: Wakanui plus Templeton soil series on post-glacial alluvium
*Rainfall: mean annual 658 mm
*Temperature: mean maximum 16.50°C Mean minimum 5.56°C
*Ground frosts: mean annual 88.6 days
Wind run: mean annual 10,967 km

*Records from Lincoln College weather station nearby.

The Experimental Gardens consist of 2.0 ha in the Headquarters Block and 7.25 ha in East Block. The Headquarters Block is divided into 16-1,000m² plots where irrigation is available from a 15 cm well and oscillating spraylines; East Block also has irrigation through a grid system of underground pipes fed from a 1 million litre polythene-lined reservoir.

Propagation facilities include two 5.5 x 9.0 m glasshouses attached to a potting shed, four smaller isolation glasshouses, three 5.5 x 9.0 m lathe shadehouses with PVC roofing (one with shade cloth side protection) and new overhead automatic misting, and three 7.0 x 2.4 m cold frames. A new 9.0 x 5.0 m glasshouse has been installed for ecological experiments. Supplementary lighting and bottom heat is available in some of the glasshouses. Records of all plants handled are kept in the potting shed office.

Field equipment, housed mainly in an implement shed/lunchroom/store/ablution complex, includes a two-furrow plough, rotary hoe, two 35 hp and two 12 hp tractors. One of the larger tractors is fitted with a portable generator to power electric trimmers for hedge cutting. The smaller tractors are used for lawn mowing around the Headquarters, while East Block grassed areas are mown with a large tractor mounted rotor-cut mower. Tractor driven gun spraying equipment is used for field spraying purposes. A new double garage has been erected for the Division's vehicles.

Field plantings include indigenous species of *Cortaderia, Chionochloa, Festuca, Sophora, Fuchsia, Carmichaelia, Notospartium, Chordospartium, Corallospartium, Pachystegia, Hebe, Leptospermum, and Kunzea.* Ornamental plantings of conifers, *Hebe, Pachystegia, Helichrysum, Plagianthus, Hoheria, Discaria,* and divaricating plants around the Division's buildings provide a further source of material for study. Two mistletoes — *Alepis flavida* and *Korthalsella lindsayi* are established on hosts in this collection.

Plants grown in containers for scientific purposes include collections of indigenous rare and endangered species, divaricating plants, ferns, conifers, orchids, grasses, outlying and Pacific Island species, *Astelia, Parahebe, Uncinia, Carex, Scandia, Acaena, Celmisia, Raoulia, Leucogenes, Hydrocotyle, Gunnera, Aster, Erigeron, Rubus, Sedum, Hieracium, Trinia, Ranunculus, Podocarpus, Crassula, Leucopogon, Soliva, Lepidium,* and *Scleranthus.*

A collection of 60 noxious plants, grown in 30 x 30 cm tubs, is maintained

for use at agricultural shows and field days, and for weed identification talks to interested groups.

A large collection of indigenous *Nothofagus* species, supplied by the Forest Research Institute, Ilam, is established at East Block. This collection supplements existing plantings of *Sophora, Olearia, Phormium,* and shelter trees and is part of a continuing programme to establish a permanent collection of indigenous plants (grouped according to families and genera), and an overall landscape plan.

Since the last Triennial Report further site developments of the Lincoln Research Centre have affected the Division's experimental plots and grounds. The most notable is the new eastern road entrance through the plots to the Centre. To accommodate this, existing shelter hedges and indigenous plantings have been removed. Interim and long-term measures have been taken to landscape affected areas until site developments are completed. Indigenous trees, shrubs, and tussocks are now in place along the eastern road verge through the plots. A further loss in existing plot area has resulted from the planting of exotic trees (*Cedrus, Quercus*) along the main road frontage as part of the overall Centre landscape plan to link existing exotic plantings along the Lincoln College frontage with those in the Lincoln township.

ART AND GRAPHICS

(Dr M.S. McGlone)

The illustrators have faced a period of rapid change. With the increasing emphasis on the DSIR communicating effectively both with its clients and the public, the demand for displays, cover designs and other promotional material has burgeoned. At the same time, the regular workload of scientific graphs and maps, and botanical illustrations has also steadily increased. There have been technological changes as well; new machinery facilitates the application of lettering, production of overhead transparencies, and photographic reproduction of artwork. Computer-drawn graphics are now widely used on campus.

Our aim is to fully integrate the illustrators into a wider inter-divisional grouping which serves the photographic, illustration, and publicity needs of the whole Centre. A step towards this is the placement of the illustrator's studio within the photographic suite in the new administration and office block.

There have been several staff changes. Ms Robyn Conway resigned in August 1983 after a stay of nearly seven years; three years as assistant to Mr Keith West and four years as botanical artist. Robyn Conway's major contribution was the completion of a substantial number of the illustrations for Volume 4 of the Flora series, and some striking and unusual cover designs for various publications.

Miss Anne Hodgins took two years leave to travel overseas in March 1984. Miss Vicky New was appointed as senior illustrator in March 1984. Ms Pat Brooke worked with Dr Peter Johnson at our Dunedin office from February 1982 on illustrations for his forthcoming book on wetland plants. In June 1984 she was appointed to the permanent staff at Lincoln.

ADVISORY AND SERVICING

(Miss S.J. Gamble)

The continued increase in advisory work facilitated the appointment of an Advisory Officer in November 1983. The Advisory Officer's duties include co-ordinating comments on Environmental Impact Reports; the organisation and distribution of the Unpublished Vegetation Report Series; handling public enquiries; preparing displays of the Division's work; organising symposia, seminars, etc.; entering botanical literature on SIRIS, a computer database; co-ordinating the Division's contribution to projects such as the National Wetlands Inventory; and writing short articles for various newsletters. Much of this work was previously done by the scientists, the remainder being developed by the Advisory Officer.

General plant information and identification continues to be the major area of servicing provided by Botany Division. Requests for species lists have risen dramatically. These are wanted by private individuals who have an area of native vegetation on their land, by organisations such as the Royal Forest and Bird Protection Society and by Government Departments such as Lands and Survey. In the last two years Botany Division has become more heavily involved in Environmental Impact Reports commenting on 68 titles in 1984 alone. The opportunity to provide a botanical viewpoint is welcomed. Titles of EIRs range from animal introduction/control to reserve management. The organisation of the Unpublished Vegetation Report series and its consequent addition to SIRIS has meant a large increase in demand for reports. The reports are a result of fieldwork carried out by Botany Division ecologists, such as vegetation survey, species lists and reserve management studies.

The most popular methods used by staff to transfer information are letters, scientific publications, telephone conversations and vegetation reports. The number of staff being asked to give talks and lectures continues to increase. In 1984, a two-day symposium entitled "Vegetation of New Zealand" was held in honour of Dr Godley's retirement. Attended by over 180 people, it was a resounding success.

Requests for information are most commonly received by telephone, mail or in person. On average, staff spend 35% of their time on servicing work, although some spend more than 50%.

Botany Division's clientele continues to expand. The following list places on record our current clients in New Zealand and overseas:

NEW ZEALAND

Accident Compensation Commission
Botanic and Private Gardens
Botanical Societies
Cabinet Select Committees
Catchment Boards and allied authorities
Centre for Resource Management
City, Borough and County Councils
Commercial and Municipal Nurseries

Commercial Firms and Consultants
Commission for the Environment
Customs Department
Department of Education
Department of Lands and Survey
DSIR Divisions (including Biological Resources Centre)
Health Department
Herbaria
Horticultural Societies
Hospitals, Medical Schools, Laboratories, Doctors
Housing Corporation
Landscape Architects
Liquid Fuels Trust Board
Department of Maori Affairs
Meteorological Service
Ministry of Agriculture and Fisheries
Ministry of Energy, Electricity Division
Ministry of Works and Development
Museums
Nassella Tussock Board
National Film Unit
Native Forest Action Council
Nature Conservation Council
New Zealand Forest Service
New Zealand Historic Places Trust
New Zealand Wool Board
Noxious Plant Authorities
Parks and Reserves Boards
Police Department
Press Journalists
Private Individuals
Publishing Houses
Queen Elizabeth II Arts Council
Queen Elizabeth II Trust
Royal Forest and Bird Protection Society
Schools
Television NZ Natural History Unit
Universities (including Extension Study Courses)
Wildlife Service

OVERSEAS
CITES Secretariat
Climatological researchers in England and USA
Colleagues
Commonwealth Science Council
Council of Heads of Australian Herbaria
CSIRO
Government Research Organisations in Europe and USA
Herbaria
IUCN

International Dendrological Society
Nature Conservation Council (Britain)
Research organisations
Pacific Islands Agriculture Department
Pacific Islands Environmental Department
Universities
World Wildlife Fund

INFORMATION SERVICES

(Dr A.D. Thomson)

BOTANY DIVISION NEWSLETTER

Because Botany Division staff are now stationed at different locations in New Zealand (presently Dunedin, Nelson, Lower Hutt, Rotorua, Havelock North, Auckland and Kaikohe) as well as at Lincoln, it was decided in 1974 to distribute a *Botany Division Newsletter*. Its aim is to provide a forum for staff, provide a permanent record of many facets of the work of the Division for the benefit of staff and botanists outside the Division, and maintain staff links and so help engender an *esprit de corps*. From time to time relevant contributions from outside the Division are included. To provide what is at present the only record of activities at the Lincoln DSIR Centre, reports are included on seminars, notable visitors, etc. at the Centre. To help enliven the Newsletter it has been made the venue for providing a permanent record of new unpublished information relating to the history of New Zealand botany and the life and work of Leonard Cockayne. This has the added advantage of providing an opportunity to assemble the extensive material relating to Cockayne as a preliminary to the publication of the full biography and the data is permanently available in the Newsletter. Innovations in more recent issues include illustrations of interest to Botany Division and New Zealand botany.

BD Newsletter is distributed approximately monthly. Every effort is made to provide a completely accurate and authoritative Newsletter which will provide a long-term accessible record of the work of Botany Division. Though the Newsletter is widely distributed in New Zealand and to some colleagues and institutions overseas, it is not formally published; copies are lodged in the DSIR Lincoln Library and in the DSIR Library Centre, Petone, but not the General Assembly, Turnbull or Hocken Libraries. Three complete bound sets are also retained by Dr Thomson as well as the master copies of all issues. Between June 1974 and December 1984, 99 numbers plus one supplement were distributed. Supplement No. 1 records the Botany Division Biennial Meeting in 1983. The total distribution is now about 200 copies and the Newsletter is available to most botanists in New Zealand, including the seven university botany and plant science departments. In due course it is hoped to complete a full index to the Newsletter. For a number of years Botany Division has acted as a centre for the distribution of informal periodicals containing botanical information. As well as the *Botany*

Division Newsletter the following two journals have been prepared and distributed from the Division:

Beech Research News

This journal was first published in 1974 under the auspices of the Scientific Co-ordinating Committee for Beech Research and informally records research on beech forests and related matters. Eight issues of *Beech Research News* have been published, No. 1 in 1974 and No. 8 in 1983. Because the Scientific Co-ordinating Committee has fulfilled its terms of reference and has been disbanded as such, further issues of *Beech Research News* are not planned at present.

N.Z. Genetical Society Newsletter

The N.Z. Genetical Society Newsletter was first published in 1976 from Botany Division, although it is independent of the Division. It aims to informally record aspects of genetics in New Zealand. After seven issues the lack of adequate finance has temporarily curtailed this publication.

TAXONOMY

(Dr E. Edgar and Dr C.J. Webb)

Plant taxonomy within DSIR had its origin with the establishment in 1928 of the Plant Research Station; this had the function of providing plant identifications and undertaking the taxonomic research necessary as a basis for reliable identifications. The Taxonomy Section within Botany Division continues this vital role today. Knowledge of the correct name of a plant gives access to all types of information relating to that plant. In addition, when a plant is correctly identified as to genus and family it can also be assumed that it will possess characters known in other plants belonging to the same genus and family. Consequently the processes of identification and classification of plants lay the framework for much other botanical research.

In fulfilling its role the Taxonomy Section:

1. Provides an identification service for all higher plants and some lower plant groups, i.e. identifications of flowering plants, conifers, ferns, mosses, liverworts, and marine and freshwater algae.
2. Provides expert opinion on other aspects of plant biology, e.g. poisonous plants, weed potential, reproductive biology.
3. Produces floras and identification manuals which classify and describe all wild New Zealand flowering plants, conifers, and ferns. Three volumes of Flora of New Zealand have been published, two volumes are well advanced towards publication. These two volumes, one dealing with dicotyledon weeds, one with grasses, are urgently needed. Currently in New Zealand there is no book available which describes all dicotyledon weeds present in the country, with keys to their identification, and there is no book describing all grasses both native and naturalised.
4. Carries out biosystematic research which increases our knowledge of the structures, functions and evolution of particular plant groups,

and provides the information on which Floras and taxonomic revisions are based.

Plant taxonomists must deal with all plants growing in New Zealand, whether native, introduced accidentally as weeds, or introduced purposefully for agriculture or horticulture. Major client areas are:

1. Agriculture; especially weed identification for Ministry of Agriculture and Fisheries, also identification of crop plants, and identification of known or new noxious weeds.
2. Horticulture; identification and expert advice on cultivated plants.
3. Ecology and Conservation; mainly identification of native plants. Recognition of the rarity of native plants is confirmed by taxonomic revision of the groups to which they belong.

Forensic work is also undertaken, and advice given on legally or illegally imported plants, and on any unfavourable characteristics of plants proposed for import.

Much of the resource of the Taxonomy Section must reside in the cumulative experience of the specialists in particular plant groups, who carry on taxonomic research within Botany Division. The Herbarium, Library and Experimental Gardens are vital to their work.

In the next 25 years agriculturalists and horticulturalists will be major users of plants. They depend on taxonomic botanists for the correct identification of the plants they grow so that they can have access to further information about these plants. They also depend on taxonomic botanists for information on plants which would be undesirable to allow into the country and for information on plants which could usefully be grown here. Botanists will be needed who have specialist knowledge of classification and nomenclature of the principal agro-economic plant families–the grasses, composites and legumes.

The flora of New Zealand is constantly changing as new species are introduced to horticulture and agriculture, and new species establish as weeds. In addition, both the native and introduced floras require reinterpretation as new classifications are published in New Zealand and overseas. Many groups within the native flora are poorly understood, and taxonomic research in these groups is a necessary first step towards a new edition of Volume 1 of the Flora of New Zealand.

Even when New Zealand's plants are better known it will still be essential to have a core group of plant taxonomists to interpret the flora be it native, naturalised, or cultivated.

Dicotyledons

Dr C.J. Webb reports that continued progress has been made with the volume of Flora of New Zealand dealing with naturalised dicotyledons. Mr W.R. Sykes has revised much of the large section of text for which he is responsible, Dr D.R. Given has almost completed a revision of his treatment for Rosaceae, and Dr P.J. Garnock-Jones and Dr Webb have completed revisions of their texts. Dr Webb, as editor of the volume, has assessed, standardised and edited about half of the completed text, and also supervised the proof-reading and checking of the Flora by Ms J.E. Shand, Ms M.A. Bloomfield, and wage and Project Employment Programme workers. An adequate first draft has not yet been prepared for the largest family in the

flora, the Compositae; Dr Webb has just begun a treatment of the subfamily Asteroideae and has completed the tribe Anthemideae, and Dr Garnock-Jones has started on the second subfamily, the Cichorioideae.

In some genera where the account of naturalised species has to be integrated with that for native species, new combinations have had to be made and some new native taxa described. In *Ranunculus* Dr Garnock-Jones, with Mr H.D. Wilson, has described two new species from Stewart Island, *R. stylosus* and *R. viridis (N.Z. J. Botany 21*: 341-345). In *Crassula* Dr Given and Mr A.P. Druce have made new combinations for six native species formerly placed in *Tillaea (N.Z. J. Botany 22*: 583). A proposal to reject the name *Epilobium junceum* Sprengel has been submitted to the Committee for Spermatophyta of the International Association of Plant Taxonomists by Dr Garnock-Jones (*Taxon 32*: 656-658) because the name *E. junceum* has been persistently misapplied from the time of Banks and Solander to a taxon which does not include its type, i.e. to *E. billardierianum* subsp. *cinereum*. Miss B.H. Macmillan is currently revising the indigenous species of *Acaena* (Rosaceae) so that a key to some 17 naturalised and native species can be prepared for the forthcoming Flora volume. She has raised Bitter's *Acaena sanguisorbae* ssp. *profundeincisa* to specific rank (*N.Z. J. Botany 21*: 347-352) and is now examining the status of *A. pusilla, A. viridior* and *A. hirsutula*. Her revision of *Acaena* has resulted in the recognition of five new taxa, and the range of *A. microphylla* has been found to be restricted, with var. *microphylla* occurring in central North Island and var. *pauciglochidiata* in coastal Southland and Stewart Island. South Island plants formerly referred to as *A. microphylla* var. *robusta* are in fact a spine-fruited form of *A. inermis*.

One unexpected result of work on the naturalised dicotyledon flora has been the addition of the genus *Ceratocephalus* (Ranunculaceae) to the indigenous flora. Dr Garnock-Jones found that New Zealand plants do not match either of the two Eurasian species, *C. falcatus* and *C. teticulatus* which formerly comprised the genus. He described a new endemic species, *C. pungens,* from dry inland basins of the Mackenzie Country and Central Otago (*N.Z. J. Botany 22*: 135-137). In the Umbelliferae, too, a new native species of *Hydrocotyle* has been recognised from material referred to the Australian *H. tripartita*. Dr Webb and Dr P.N. Johnson investigated the 3-foliolate species of *Hydrocotyle* in New Zealand. They found that New Zealand plants formerly considered conspecific with *H. tripartita* are glabrous rather than pilose, with a different leaflet shape and less prominent fruit ribs (*N.Z. J. Botany 20*: 163-168). They describe New Zealand plants as a new species, *H. sulcata*, which has 2n = 72, and accept Petrie's *H. hydrophila*, a smaller, more northerly lowland species with 2n = 144. The Australian *H. tripartita* does occur in New Zealand but only as a recent introduction to the Auckland area. Also in Umbelliferae Dr Webb has reported on heterophylly in *Eryngium vesiculosum (N.Z. J. Botany 22*: 29-33) where summer leaves are laminoid and prickly and winter leaves linear and fistular. Experiments using controlled conditions showed that daylength cues the change of leaf form and that total immersion in water affects leaf form to a lesser extent and prevents flowering. Dr Webb has also described with Mr Druce the natural intergeneric hybrid *Aciphylla squarrosa* x *Gingidia montana (N.Z. J. Botany 22*: 403-411). The occurrence of this hybrid indicates a closer relationship between

the two genera than has been previously suggested. They list known intergeneric hybrids between *Aciphylla* and *Anisotome* as well as a large number of interspecific hybrids recorded within these two genera and within *Gingidia*. This high frequency of hybridism within New Zealand Umbelliferae is in marked contrast to the rarity of hybrids in Umbelliferae elsewhere in the world.

Some other revisions have been solely concerned with native species. In a preliminary treatment of Cunoniaceae for Flora Malesiana, Hoogland in 1979 (*Blumea 25*: 481-505) reduced *Ackama* and five other genera to synonymy under *Caldcluvia*. Dr E.J. Godley queried this decision (*N.Z. J. Botany 21*: 455-456) drawing attention to the septicidal dehiscence of the carpels in *Ackama rosifolia* and contrasting this with the limited separation of carpels of *Caldcluvia paniculata* which are held together by a flattened vertical shaft. In his view *Ackama rosifolia* and *Caldcluvia paniculata* should not be in the same genus. In the Compositae Dr Given concluded his revision of *Celmisia* subgenus Pelliculatae section Petiolatae (*N.Z. J. Botany 22*: 139-158) recognising six species within it. He particularly lists interspecific hybrids; in these, the widespread species *C. spectabilis* and *C. verbascifolia*, as well as *C. traversii*, are commonly involved. With Dr W.G. Lee, Dr Given re-examined the status of *C. spedenii* (*N.Z. J. Botany 22*: 585-592) and they described the new species *C. markii*. In Scrophulariaceae Dr Garnock-Jones and Dr B.P.J. Molloy reviewed the *Hebe amplexicaulis* complex (*N.Z. J. Botany 20*: 391-399). *H. allanii* is reduced to synonymy in *H. amplexicaulis*, the main difference between the two being the presence of the leaf and stem pubescence in *H. allanii* which is controlled by a single dominant gene. They provided the new name *H. amplexicaulis* forma *hirta* for the hairy morph. The new species *H. pareora*, from rock outcrops and cliffs in south Canterbury, was also described. Also in Scrophulariaceae Dr M. Kalin-Arroyo has published new species and combinations in *Ourisia* (*N.Z. J. Botany 22*: 447-463). This forms part of the systematic revision of New Zealand species in the genus, which Dr Kalin-Arroyo worked towards when she was at Botany Division in 1974.

In the Papilionaceae Mr A.W. Purdie is investigating the native broom genera *Carmichaelia, Chordospatium, Notospartium* and *Corallospartium*. All species have been propagated and are being grown at Lincoln in the Botany Division experimental gardens. The living plant collection now includes specimens of *Carmichaelia prona*, a species formerly extinct in New Zealand but which in 1982 was found growing at the Royal Botanic Garden, Edinburgh. *Chordospartium* is currently being studied. Specimens are being grown at Lincoln of the endangered Marlborough species, *C. stevensonii*, from all known natural populations, including the Avon Valley where the species is now extinct. A new species, *C. muritai*, has been described (*N.Z. J. Botany 23*: 157-161). This rare tree broom is known from only one population at Clifford Bay, Marlborough and is distinguished from the only other species of the genus, *C. stevensonii*, by its upright branchlet habit, distinctly erect racemes, flower colour and size, and smaller pods and seeds. In addition, a taxonomic revision of *Notospartium* is well advanced. Of the three known species, *N. torulosum* of Canterbury is quite distinct, but the two species from Marlborough, *N. carmichaeliae* and *N. glabrescens*, may prove to be ecotypes of a single species.

Revision of *Carmichaelia* continues with particular attention being given to a high level of intraspecific variation which is such a strong feature of the genus. Mr Purdie is making a chemotaxonomic study of this genus. A comprehensive analysis of flavonoids in the phylloclades of 31 species of *Carmichaelia (N.Z. J. Botany 22:* 7-14) showed the presence of isoflavones, flavonol 3-0-glycosides, flavonol 7-0-glycosides, flavonol 3,7-di-0-glycosides and flavone C-glycosides. The distribution patterns of these naturally-occurring flavonoid components, together with the presence of variable intraspecific characters, and the present lack of distinct characters to delimit species of *Carmichaelia,* suggests that many entities currently recognised may be conspecific. The taxonomic treatment of, for example, the closely-related and variable shrub species of the eastern South Island *(C. ovata, C. robusta, C. violacea, C. appressa, C. rivulata, C. petriei, C. ramosa,* and *C. hookeri)* and of the corresponding North Island species *(C. aligera, C. cunninghamii, C. silvatica, C. egmontiana, C. solandri, C. flagelliformis,* and *C. hookeri)* could be simplified when their similar flavonoid chemistry is considered. Flavonol aglycones, produced by acid hydrolysis of the natural 3-0-glycosides, where also examined. These have a significant geographical distribution and also indicate closer relationships between some species.

In a paper on constraints on the evolution of plant breeding systems and their relevance to systematics, Dr Webb (*in* W. Grant (Editor) "Plant Biosystematics", pp. 249-270, 1984) defines phylogenetic constraint as the way in which strictures on a particular character, which are a consequence of the evolutionary history of a taxon, influence the current lability of that character. This concept is examined in relation to stamen number in selected New Zealand species of Umbelliferae, Gentianaceae, and Ranunculaceae.

Flowers of the Umbelliferae consistently have five stamens and two ovules, but the breeding system varies with the addition of unisexual flowers and differences in the amount of pollen per anther. In *Gentiana,* stamen number is constant, while number of pollen grains per anther, and ovule number, vary. In *Ranunculus* both stamen number and ovule number vary, but the number of pollen grains per anther is fairly constant.

The extent of constraint on a particular character influences its usefulness to biosystematics; the most useful characters at generic and specific level are those which are neither completely constrained nor completely labile. The importance of understanding the functional significance of reproductive characters before using them in systematics is also stressed.

In 1982 the results of many years intensive field observation on native plants by Mr A.P. Druce were summarised in the second series of Audrey Eagle's botanical paintings "Eagle's Trees and Shrubs of New Zealand". The work was dedicated to Tony Druce "who shared his knowledge and made this book possible". Full botanical notes accompany the plates and the book includes about 60 undescribed new entities all fully illustrated with short descriptions indicating features by which they can be distinguished, followed by notes on their distribution. In addition, tables are provided for the large genera *Brachyglottis, Carmichaelia, Coprosma, Dracophyllum, Hebe, Olearia, Pimelea, Pittosporum,* and *Pseudopanax,* showing the distribution of each species and listing names of dubious standing.

In 1982, also, Mr Druce compiled an unpublished checklist of "Indigenous Higher Plants of N.W. Nelson and Indigenous Higher Plants of New Zealand

not in N.W. Nelson", and he continues in retirement to revise this overview of the New Zealand flora.

MONOCOTYLEDONS: GRAMINEAE

Investigations have proceeded on several genera towards the treatment in the Flora of New Zealand volume dealing with grasses.

Dr H.E. Connor collaborated with Dr A. Löve of Montreal (*N.Z. J. Botany 20*: 169-186) in a study of the genomic constitution of the New Zealand taxa referred in the past [Cheeseman, T.F. 1925 (*Man. N.Z. Fl.* 210-212)] to *Agropyron* and *Asprella* (*Cockaynea*). All taxa have genomes characterised by haplomes H and S, and are now referred to *Elymus*, and to two sections in that genus: the five species formerly recognised in *Agropyron* are placed in section Anthosachne, the two species of the genus more recently known as *Cockaynea* comprise the endemic section Stenostachys. One new species is recognised, *E. apricus*, from Central Otago. The familiar name *Agropyron scabrum* applies to an eastern Australian taxon with short awns; plants of this type do not occur in New Zealand. The name *E. rectisetus* is applied here to the common long-awned plants of the tussock grasslands.

In a revision of New Zealand species of *Dichelachne*, Dr E. Edgar and Dr Connor recognised five species (*N.Z. J. Botany 20*: 303-309). Three are indigenous and shared with Australia, viz *D. crinita, D. micrantha*, which replaces *D. sciurea*, and *D. inaequiglumis*, based on *D. sciurea* var. *inaequiglumis*. Two species are naturalised from Australia, *D. rara* and *D. sieberiana*, a revived name for the taxon recently described as *D. rara* ssp. *asperula* Veldkamp.

All available types based on New Zealand specimens of *Poa* have now been studied by Dr Edgar and the final typescript of a revision of New Zealand *Poa* is being prepared. Several species recognised in Cheeseman's Manual of the New Zealand Flora (1925) are considered better treated as synonyms. For example *P. astonii*, based on specimens from near Dunedin, and *P. oraria* based on specimens from Deep Cove, are considered to be two extremes of a taxon which occurs on the southern coast from Dunedin to Fiordland and also on Stewart, Snares, Auckland and Campbell Islands. It has also recently been found on Banks Peninsula by Mr H.D. Wilson. Plants resemble *Poa colensoi* but have compact panicles. *Poa astonii*, as the older name, has priority over *P. oraria*. For many years the type of *P. incrassata* from Auckland Islands could not be matched with any other species. Recently, plants intermediate between *P. incrassata* and *P. exigua* of Central Otago were collected on Stewart Island by Mr H.D. Wilson. The two extremes are united in one taxon under the later name *P. incrassata* because the earlier name *P. exigua* Hook. f. is invalidated by the even earlier *P. exigua* Dumort. from Belgium. Other taxa treated by Cheeseman as varieties are considered to merit specific rank and some new entities require description. The number of indigenous species of *Poa* totals 35 in comparison with the 28 species treated in Cheeseman's Manual. There are also some 10 naturalised species.

A draft treatment of subfamily Panicoideae for the Flora volume is almost completed. Naturalised species far outnumber indigenous species in this subfamily. In New Zealand *Digitaria, Setaria, Paspalum, Panicum* and *Pennisetum*, are the genera with most representatives. *Pennisetum macrourum* is classified as a noxious plant in some districts. Most panicoid grasses occur

in the North Island or in Nelson in the South Island. Only *Digitaria sanguinalis, Echinochloa crusgallli, Paspalum dilatatum, Panicum capillare* and *P. miliaceum* and some species of *Setaria* occur to the south of Nelson and recently these have become more common southwards to Otago.

Nomina Nova

The third part in this series listing all newly published names and name-changes referable to indigenous gymnosperms and angiosperms was compiled by Dr Edgar and Dr Connor (*N.Z. J. Botany 21*: 421-441). They are now preparing a consolidated list from the three previous publications, in which the families will be arranged as in Flora of New Zealand Volumes I and II and special attention will be paid to comparison of recent major taxonomic revisions with the accounts in Volumes I and II of the Flora.

CSIRO/DSIR Colloquium

Seven Botany Division scientists, as well as the previous Director, Dr H.E. Connor, attended the CSIRO/DSIR Colloquium on Plant Taxonomy held at the Division of Plant Industry, CSIRO, Black Mountain, Canberra from 26 September to 2 October 1983. There were 35 Australian botanists present including taxonomists from most of the State herbaria as well as from universities and from CSIRO. The formal sessions of the first two days centred on the topic "Plants known by the same name in New Zealand and Australia which are different; and plants known by different names in New Zealand and Australia which are the same". In the following two days allocated to informal discussion, there was ample opportunity to visit research institutions in Canberra, to discuss computerised methods, new techniques, and to consult herbaria and living collections. The important roles played by the National Botanic Garden at Canberra and the Bureau of Flora and Fauna in the recent resurgence of Australian plant taxonomy were considered. For the fifth day Dr Bryan Barlow, Head of Genetic Resources and Biosystematics and Curator of the Australian National Herbarium, CSIRO, had organised two symposia, on reproductive biology and Gondwanan taxonomy and biosystematics. He also arranged a field excursion from Canberra to Moss Vale to Sydney in which most of the New Zealanders participated together with Dr Barlow, Dr A.E. Orchard, Herbarium of Tasmania and Mr R. Pullen, CSIRO, Canberra.

In a formal resolution passed by the meeting, participants at the colloquium recommended that co-operation between Australian and New Zealand botanists should be developed, particularly in the fields of exchange visits of personnel, joint field expeditions, promotion of joint taxonomic projects, exchange of information, and exchange of material of related Australasian plants.

Ferns

Dr Given discussed the disjunct distribution of *Sticherus flabellatus* found in northern North Island and near Takaka and Stockton in the northwest of the South Island (*N.Z. J. Botany 20*: 381-385). With Dr K.A. Markham and Miss N.A. Moore of Chemistry Division, DSIR, he was involved in a phytochemical reappraisal of taxonomic subdivisions of *Lycopodium* based on flavonoid glycoside distribution. From their investigation of New Zealand material and of some French and Japanese species they concluded that

Lycopodium sens. lat. could be subdivided into three goups. One of these, containing the type species of *Lycopodium*, was further divisible. The related genus *Phylloglossum* is phytochemically distinct.

BRYOPHYTES

Dr A.J. Fife came to Botany Division as an NRAC Fellow in September 1982, with research interests in moss taxonomy and phytogeography. In the last three years he has been concerned with the widespread family Funariaceae, particularly the genus *Entosthodon*, for which a draft revision has been completed for the eight taxa occurring in New Zealand. Some major findings of this study are (1) *Funaria subattenuata*, formerly thought to be a New Zealand endemic species, is synonymous with *Entosthodon laxus* from Kerguelen, so extending its range from alpine regions throughout New Zealand, to Tasmania, Victoria, Macquarie Island, Kerguelen, Marion Island, southern Chile, and Venezuela; (2) the taxon commonly known as *Funaria glabra* in New Zealand and Australia should be referred to *Entosthodon acaulis*, whereas the type material of *Funaria glabra*, from Western Australia, is identical with *Entosthodon muehlenbergii*, a widespread species which was previously unrecorded for Australasia, and is now found to be sparsely distributed throughout Australia and also occurs in New Zealand in Central Otago and on Banks Peninsula; (3) *Entosthodon productus*, known from the North Island, Tasmania, and several Australian states, is closely allied and probably identical with a poorly known high-elevation species of Melanesia, *E. mittenii*. A considerable number of collections, including many types, have been examined of *Entosthodon* species from Australia, New Guinea, New Caledonia, the Subantarctic Islands, and South America, in an effort to correlate the New Zealand flora with the floras of these regions. Also in the Funariaceae, a new genus is in press to accommodate a widespread species which seems to be a New Zealand endemic.

Intensive collections of mosses have been made in the Punakaiki-Paparoa Mountain region and on the basis of *c.* 1250 collections a regional catalogue of 227 species has been prepared, accompanied by data on microhabitat and altitudinal distributions. Collections have also been made in a range of other localities, some of the more significant being North Auckland, Wellington (Akatarawa Mountains), Nelson (Mt. Owen and Karamea regions), and Canterbury (especially Banks Peninsula and Arthurs Pass National Park). These collections have yielded the first New Zealand records of eleven species (mostly reported in *N.Z. J. Botany 22*: 1-6), as well as type material of two newly described species, *Racomitrium crumianum* (*N.Z. J. Botany 22*: 1) and a species of *Pohlia*, to be published jointly with Dr A.J. Shaw of the Smithsonian Institution. New taxa have been discovered in the genera *Hookeria* and *Pohlia*; these await publication. Some temperate Northern Hemisphere species are newly recorded for New Zealand predominantly or exclusively in alpine environments. Also newly recorded from New Zealand is *Distichophyllum kraussei*, previously known only from southern Chile, which is now known from eleven localities on the North, South, Stewart and Auckland Islands. A discussion of this species in New Zealand has been prepared in association with Dr Celina Matteri of the Argentinian National Museum.

In October 1983 a three-day field workshop was organized by Dr Fife

at Pelorus Bridge Scenic Reserve in Marlborough and about 30 people attended. This workshop attracted such interest that a second meeting was organized from outside the Division and it is now intended that a bryophyte workshop will be held annually in New Zealand.

During the past two years discussions have been held with Prof. R.M. Schuster (University of Massachusetts, Amherst) and Dr J.J. Engel (Field Museum, Chicago) concerning the possibility of their preparing a floristic treatment of the hepatics and hornworts of New Zealand within the Flora of New Zealand series. Professor Schuster and Dr Engel have extensive experience with Southern Hemisphere temperate hepatics, including those of New Zealand. Current plans call for an illustrated hepatic-hornwort flora to be completed in 1991. Preliminary plans have also been made for a Flora volume dealing with the New Zealand mosses, to be prepared by Dr Fife, to replace Sainsbury's "Handbook of New Zealand Mosses" published in 1955.

LICHENS

When Dr D.J. Galloway resigned from Botany Division in March 1982 the manuscript text for "Flora of New Zealand Lichens" was almost ready to transfer to word-processor. Over the next three years Dr Edgar, in consultation with Dr Galloway, supervised word-processing, proof reading, indexing, editing and other details through all stages of printing and by November 1984 the final page proofs had been approved. The publication date for the Lichen Flora was 8 February 1985. Throughout the very protracted time of printing Dr Galloway made every endeavour to keep the information in the Flora up-to-date. He was ably assisted in this by Mrs C. MacDonald and Dr M.C. Wassilieff of Science Information Publishing Centre, DSIR, who oversaw the insertion of alterations and footnotes at a very late stage in the printing.

"Flora of New Zealand Lichens" is the first volume dealing with cryptogams to be published in the Flora of New Zealand series and the first major Southern Hemisphere lichen flora to be produced this century. It discusses 966 taxa in 210 genera. The format of the volume is very similar to that of the other three volumes in the Flora of New Zealand series. Introductory chapters include a brief history of lichenological exploration in New Zealand, a list of collectors of New Zealand lichens whose specimens are known in major herbaria throughout the world, the "Annals of Taxonomic Research on New Zealand Lichens, 1781-1983" which contains references to taxonomic work dealing with lichens occurring in New Zealand, a list of names of authors of lichen taxa, and a key to genera subdivided into crustose, placodioid, squamulose, foliose, filamentous and fructicose lichens. The main body of the text is arranged under genera in alphabetical order, but in the notes to each genus reference is made to the family or families within which the genus is usually placed. In species descriptions the chemical characters, where known, are fully noted and each species is given a biogeographical designation. The biogeographical elements recognised in the New Zealand lichen flora were set out in the previous Triennial Report. Footnotes to many of the species highlight their distinguishing characters.

Dr Galloway acknowledges the help of numerous lichenologists from many parts of the world. Contributions to the text of the Flora were made by

Mr P.W. James of the British Museum who prepared the account of *Menegazzia* and checked the final text and especially the key to genera, Dr L. Tibell of Uppsala who wrote the accounts of genera in the Caliciales, Dr B.J. Coppins contributed the text for *Cliostomum* and *Micarea*, Dr D.L. Hawksworth wrote the accounts of *Anisomjeridium* and *Mycomicrothelia*, and Dr J. Hafellner and Dr H. Mayrhofer of Graz provided the text for *Brigantiaea* ande *Rinodina* respectively.

MARINE ALGAE

Dr M.J. Parsons spent 1982 at the University of Adelaide, South Australia, where he worked with Professor H.B.S. Womersley on the southern Australian and New Zealand species of *Dasya* (Rhodophyta). A total of 70 taxa are reviewed in this study. All except two of the types of these taxa have been located and examined in detail. Forty taxa are now placed in genera other than *Dasya* and six names referred to synonymy with other *Dasya* species. At least 22 species of *Dasya* occur in southern Australia, emphasising the richness of the flora, whereas New Zealand has only two species.

During 1982, Dr Parsons accompanied the Adelaide phycologists on collecting trips to Victoria, S.E. South Australia and Tasmania. Collections of genera and species also represented in New Zealand were made to be used for comparison with our material. A week was spent at the Tasmanian Herbarium, in Hobart, which holds large collections of marine algae made by Mrs Florence Perrin, but there is no phycologist on the herbarium staff. Professor Womersley and Dr Parsons sorted out these algal collections to make them available for loan.

Thirty people (including six Australians, two Canadians and families) attended the sixth phycological field meeting held 23-31 January 1983 at Halfmoon Bay, Stewart Island. This was the first field meeting held with the Australasian Society of Phycology and Aquatic Botany (ASPAB).

Dr Cameron Hay of the New Zealand Oceanographic Institute, Wellington, removed two areas of intertidal mussels (*Mytilus edulis aoteanus*) on rocky shores near Taylors Mistake, Banks Peninsula, to see if the bull kelp (*Durvillaea willana*) would regenerate further up the shore from the low tide level in the absence of mussels. These clearances have been monitored by Dr Parsons and Mrs Stolp each month during the spring tide periods for the succession of algal growths and seasonal intertidal algae and to obtain information on their periodicity.

There have been few records of algae from the west coast of the South Island. The collection of three marine algae from the Open Bay Islands, Westland, made by G. Fenwick, although not comprehensive, has provided two new records for the New Zealand flora as well as extending the distributions of other algae.

A paper by R.E. Norris, E.M. Wollaston and M.J. Parsons (*Phycologia 23*: 233-237) on sympodial growth in the Ceramiales (Rhodophyta) has distinguished the cellulo-sympodial growth characteristic of the family Dasyaceae, a very precise kind of apical cell division, from the rather less exact kind called ramisympodial growth as found in *Crouaria, Gattya, Lomentaria, Sympodophyllum* and many other genera of red algae.

FRESHWATER ALGAE

Dr U.V. Cassie-Cooper has recorded a total of 2076 freshwater micro-

algae, including 548 diatoms, from New Zealand waterways (NWASCO Technical Reports 25 and 26; Bibliotheca Diatomologica Band 4). These lists will form the basis for preparation of a freshwater algal flora of New Zealand. The 3-volume Flora of New Zealand Desmids (H. Croasdale and E.A. Flint, Vol. 1 in press, Vols 2 and 3 in preparation) provides the first major section on the taxonomy of this little-known group of microscopic plants. A preserved and dried herbarium now includes more than 3,300 samples, as well as over 900 photo-micrographs and 300 prepared slides.

Current field-work and microscopic studies (L.M. and S.E.M.), centred round cyanobacteria and algae of hot springs and streams, are providing a wealth of data on hitherto unrecorded or little-known taxa of freshwater algae, particularly diatoms and blue-greens. Although 145 species of thermophilic algae are recorded in the literature to date, the validity of a number of these is open to question; there are still many taxonomic anomalies to be sorted out. A feature of the field-work has been the confirmation of observations made by the American geologist W. Harvey Weed late last century (*U.S. Geol. Survey Ann. Rept. 9*: 613-676, 1899) that algae are major contributors to the formation of siliceous sinter and travertine terraces, where they become solidifed and cemented in by rapid deposition of these substances.

Freshwater Algal Cultures

In anticipation of further taxonomic work in Botany Division on the freshwater micro-algae Dr Parsons and Mrs Stolp are maintaining a collection of freshwater algae in culture.

This collection was established at the University of Canterbury in 1956 by Dr Elizabeth A. Flint, who, while working for the Soil Bureau of DSIR, isolated and described algae from soils of New Zealand and Antarctica and from green-coloured ice from the Balleny Islands, Antarctica. The cultures were grown in a converted potting shed which had initially no means of temperature regulation. Later a small heat exchanger was installed to cool the shed, but there was no critical control of temperature and the other conditions of growth. In 1966, shortly after the University moved from the town site in Christchurch to the present location at Ilam, the cultures were transferred into a growth room.

In 1974, when Dr Graeme MacRaild was appointed as a phycologist at the University of Canterbury, he took up the development of the collection and added to it. During 1979-1980, Dr Ojvind Moestrup from the University of Copenhagen, also added several marine planktonic algae to the collection but culture of these was discontinued in 1982 when Dr MacRaild resigned.

After some negotiation Botany Division agreed on 25 January 1984 to receive the cultures of 87 isolates of 68 species, the culture equipment and the heat exchanger. Three weeks later a further 15 cultures of species isolated from Lake Ellesmere by Dr Ian Lineham were added to the collection. As a general policy this collection of algal cultures is being maintained at least until the end of 1986.

Conservation of Threatened Species

Perhaps one of the major achievements in this area was the survey of vegetation and flora of Chatham Island by Dr P.A. Williams and Dr D.R. Given in 1982, the results of which were published late in 1984. Many

communities and populations of endemic species are of uncertain future or are, as yet, under-represented within existing reserves. Most parts of the island were visited and reassessments made of the earlier conservation proposals of Mr G.C. Kelly. Since Mr Kelly's visits in the late 1960s and early 1970s some parts of the island, especially in the northern sections, have changed dramatically under the pressure of land development. On the southern tablelands the rate of change has been slower, although even here a few sites can be described as "near-pasture".

Through much of 1983, the Threatened Plants Group of the Division (D.R. Given, P.A. Williams, W.R. Sykes) were involved in assessing legislative proposals: firstly, proposed amendments to the 'Wildlife Act', and, secondly, amendments proposed in anticipation of a revision of the Native Plant Protection Act. The Division was also involved in discussions on the Convention for International Trade in Endangered Species of Fauna and Flora and the proposal that New Zealand should become a signatory to this.

In November 1984, Miss C.M. Brown commenced work on a Guide to Threatened Plants, financed by a grant from the N.Z. Lottery Board. This guide will include short illustrated accounts of about 100 extinct, endangered and vulnerable taxa in the New Zealand botanical region. It is being written partly in anticipation of proposed changes in legislation which will update the Native Plant Protection Act.

Another main task has been to consolidate the data bank to facilitate use by both Divisional and outside staff, and to allow rapid updating and checking of entries.

REPRODUCTIVE BIOLOGY

(Dr C.J. Webb)

This triennium, with the retirement of Dr E.J. Godley and Dr H.E. Connor, marks the end of an era in the study of reproductive biology at Botany Division. The symposium held to mark Dr Godley's retirement included a session on reproductive biology: the keynote paper "Progress in understanding the natural history of New Zealand plants" was presented by Dr D.G. Lloyd, University of Canterbury, and short, complementary papers were presented by Dr P.J. Garnock-Jones, "Adaptations to self-pollination in *Parahebe*", and Dr B.A. Holloway, Entomology Division, DSIR, "Hover flies as potential pollinators of New Zealand plants".

A wide range of other projects have been completed and brought to publication, and these include many of those carried out by Dr Webb while he was on study leave in Costa Rica, Central America, in 1981.

1. Dichogamy

Dichogamy is the temporal separation of pollen and stigma presentation and may take one of two forms — *protandrous* flowers are those in which pollen is presented earlier than are stigmas, and *protogynous* flowers are those in which stigmas are presented before pollen is released. Dr Garnock-Jones and Dr B.P.J. Molloy have described strong protandry for individual flowers

of *Hebe amplexicaulis* (*N.Z. J. Botany 20*: 401-403). In this species automatic self-pollination is prevented by protandry, but insect-mediated pollination between flowers of the same plant (geitonogamy) may still occur. They have shown that seedlings derived from such self-pollination may suffer considerable inbreeding depression. The effective level of inbreeding in natural populations is probably, therefore, very low.

Protogyny is reported by Dr Webb for the Costa Rican umbellifer *Myrrhidendron donnellsmithii* (*Systematic Botany 9*: 240-246). This species is andromonoecious with the protogynous hermaphrodite flowers concentrated in the outer umbellets of the secondary compound umbels. In both male and hermaphrodite flowers, the petals are infolded and along with the filaments form a floral tube which guides specialised visitors to the nectar at the base of the styles. Protogyny, rather than protandry as in most umbellifers, is probably the favoured form of dichogamy in *Myrrhidendron* because delaying anther dehiscence postpones disruption of the floral tube.

2. Flower Colours

In several New Zealand genera, the species which occur in the Subantarctic Islands have more colourful flowers than do their relatives on the mainland. One such genus is *Gentiana*, and in a detailed investigation of two subantarctic species Dr Godley has described variation in flower colour as well as other aspects of their reproductive biology (*N.Z. J. Botany 20*: 405-420). Although both *G. antarctica* and *G. antipoda* are usually regarded as having brightly coloured flowers, white-flowered plants in fact constitute 20-80% of their populations on Campbell and Antipodes Islands. Also, among plants with coloured flowers, there is considerable variation in the pattern and intensity of colouring. Dr Godley points out that other genera with colourful subantarctic representatives show a variety of relationships with their mainland relatives, but the causes of the distribution patterns of coloured-flowered species remain obscure.

3. Sexual Systems

(a) Sexual dimorphism

In an earlier review paper (*N.Z. J. Botany 17*: 547-574) Dr Connor noted the paucity of recorded sex ratios for dioecious grasses. He has now published sex ratios for 15 populations of *Spinifex sericeus*, the indigenous sandbinding grass (*N.Z. J. Botany 22*: 569-574). In this species male and female colonies (probably single genotypes) are of equal frequency and size. Androdioecism has been reported for Australian populations of *S. sericeus*, but Dr Connor found no evidence for this in New Zealand material.

In *Cortaderia*, a grass genus which displays a range of sexually dimorphic systems as well as cosexuality and apomixis, Dr Connor examined the progeny of interspecific and intersectional crosses (*Heredity 51*: 395-403). Crosses among gynodioecious species of Section Bifida produced fertile F1 progeny, and backcrosses and selfings of F1 produced male and female plants. A cross between the two sexually reproducing species of Section Cortaderia gave similar results except that later generations showed a tendency to lethal albinism. The intersectional cross, *C. toetoe* X *C. selloana*, segregated both sex forms whereas *C. araucana* X *C. toetoe* produced female plants only.

Dr Connor suggests that species of Section Bifida share a common genetic control of male sterility, and that this differs from that found in Section Cortaderia. The intersectional crosses suggest a possible pathway to apomixis as found in several species of Section Cortaderia which consist of female plants only. Dr Connor has also recently confirmed apomixis in the South American *C. bifida* of Section Bifida (*Taxon 32*: 633-634). This is the only taxon comprising female plants only which does not belong to Section Cortaderia.

In the Salicorniaceae a range of sexual systems occur; these include hermaphroditism, andromonoecism, gynomonoecism, gynodioecism, and dioecism, and species are consistently dichogamous and wind-pollinated. For the indigenous glasswort, *Sarcocornia quinqueflora*, Dr Connor has found that some populations are hermaphroditic, whereas others are gynodioecious with the frequency of female plants varying from 12-53% (*N.Z. J. Botany 22*: 433-439). Hermaphrodite flowers are protogynous and plants are self-compatible with the overlap between pollen and stigma presentation in different flowers within a plant allowing considerable selfing to occur. Dr Connor concludes that gynodioecism appears to be a successful sexual system established from hermaphroditism in several species of *Sarcocornia*.

(b) Floral variation in *Muntingia*

In *Muntingia calabura*, a small tree of lowland Central America, all plants are similar in their sex expression, but within a plant there is continuous variation in floral form from flowers with as few as 10 stamens and large ovaries to flowers with as many as 129 stamens and very reduced ovaries. Stamen number and ovary size are related to the order in which flowers open within the inflorescence, and fruit set is more frequent in the earlier opening flowers which are those with larger ovaries and fewer stamens. Dr Webb and Dr K.S. Bawa, University of Massachusetts, have described this sexual system, the like of which has not been reported for any other species (*Evolution 37*: 1271-1282). The continuous variation in floral form, combined with the continuous flowering which characterises *M. calabura*, means that the plants can respond flexibly to the selection pressures acting on maternal and paternal components of fitness when allocating resources to stamens, pistils and to fruit maturation. In a further paper (*Biotropica 16*: 37-42), Dr Webb considers the relationship of continuous flowering in *M. calabura* to the tree's architecture, growth patterns, and flower and fruit movements. Flowers are pollinated above the branch and leaves by bees, and mature fruit is dispersed from below the branch by bats. Buds are raised into position for pollination by the pedicel, and following pollination the young fruit is lowered below the leaves to mature. These flower and fruit movements allow for simultaneous pollination and dispersal from different positions without interference — this may be essential for a continuously flowering species.

4. Pollination Biology

The pattern of pollen dispersal is not usually determined in studies of the pollination biology of outcrossing plants because the small size of pollen grains, and the rapid movement of pollinating agents, make it difficult to determine the fate of individual grains. Two methods by which pollen dispersal can be estimated, however, are by following the foraging bouts of individual pollinators, and by using fluorescent dyes to mark pollen and thereby follow

its dispersal. Both of these approaches were used by Dr Webb and Dr Bawa in a comparative investigation of two lowland tropical species in Costa Rica (*Evolution 37*: 1258-1270). They firstly described the pollination and sexual systems of the two species in order to form a basis for the comparative investigation of pollen flow. *Malvaviscus arboreus* is an hermaphroditic, hummingbird-pollinated, self-compatible shrub with its large pollen grains making it particularly suitable for pollination studies (*N.Z. J. Botany 22*: 575-581). *Cnidoscolus urens* is a monoecious, butterfly-pollinated, self-compatible annual herb (*Botanical Journal of the Linnean Society 85*: 213-223). In both species flowers usually last for only one day, but in *C. urens*, female flowers may remain receptive for up to seven days if unpollinated. In *M. arboreus*, pollen and stigmas are presented simultaneously but separated in space within the flower (herkogamy); in *C. urens*, female flowers are fewer and occur at the lowermost positions within an inflorescence — they open first and there is no overlap between male and female phases within an inflorescence.

Using fluorescent dyes, Dr Webb and Dr Bawa found that pollen was carried up to 225 metres for *M. arboreus* and up to 31 metres for *C. urens*. Pollen dispersal patterns varied from day to day, and for individual plants pollen was dispersed to and received from many plants in the population. Dispersal was less extensive for *C. urens*, probably because of the limited foraging behaviour of butterflies. In *M. arboreus*, the fate of all grains was followed for some flowers — only 3% of pollen was successful in reaching stigmas of the same or other flowers. In both species geitonogamy may occur, but this appears to be largely prevented in *C. urens* by dichogamy and the irregular foraging pattern of the pollinators — some 70% of pollen grains on stigmas were found to come from other plants. Following from these and other pollination studies, Dr Webb provided a contribution on pollination for the DSIR ALPHA series. This outlines the basic process of pollination, with particular emphasis on how plants use insects, birds, and wind as agents to achieve their pollination requirements.

5. Flower, Fruit, and Seed Abortion

The abortion of a large proportion of flowers, young fruits, or seeds within fruits is usually assumed to be the result of insufficient pollination or insufficient resources to mature fruit. However, the level of abortion is often very high and consistently so from year to year, particularly in tree species, so that pollinator or resource limitation are both unlikely explanations. In seven tropical lowland tree species, Dr Webb and Dr Bawa investigated factors causing abortions (*American Journal of Botany 71*: 736-751). In these species fruit production varied from 1-26% under open pollination, and could not be greatly increased even in controlled crosses. Aborted fruits generally contained fewer maturing seeds. Position effects within inflorescences and within pods were important, with flowers and ovules which first received pollen being less likely to be aborted. Dr Webb and Dr Bawa conclude that differences in maternal and paternal strategies may account for the high levels of abortion observed; many more flowers than can produce fruits may be necessary to attract and reward pollinators and to increase pollen dispersal, but the uncertainty of where on the plant compatible pollinations will occur, means that all flowers must retain the potential to

produce fruits. Similarly, within pods the development of more ovules than eventually produce seeds allows for the selective abortion of low quality zygotes.

PACIFIC ISLANDS

(Mr W.R. Sykes)

Kermadec Islands

Several significant events have occurred since the previous Triennial Report. There the number of goats on Raoul Island was stated to be very low. In fact the last goat was almost certainly killed in 1984. The most significant event connected with the decreasing number of goats was the rediscovery of the endemic *Hebe breviracemosa* which had not been seen since 1908. Its rarity is a direct result of browsing by goats. Although only a single plant has been found, other plants have been propagated from it by means of cuttings and seed. The steady increase on Raoul of other endemic species has continued and nearly all of them are now no longer threatened with extinction, several having become locally common.

On a visit to the Kermadecs in October 1984 the progress of the campaign to exterminate woody weeds was investigated and the four species mentioned in the 1978-81 Triennial Report as posing a serious threat have been further reduced in numbers and two are now very rare. These are *Caesalpinia decapetala*, Mysore thorn, *Senna septemtrionalis*, buttercup bush, *Psidium guajava*, yellow guava, and *P. cattleianum*, purple guava. Visits in 1984 were made to nearly all the other Kermadec Islands. With the exception of Macauley and Raoul Islands, there are no introduced mammals and few adventives on the Kermadecs. Macauley only has *Rattus exulans*, the Polynesian rat, the feral goats having been eliminated in 1970. Now the pasture-like vegetation is changing with large herbs like *Mariscus ustulatus*, *Solanum americanum* and the fern *Hypolepis* aff. *dicksonioides*, locally abundant and replacing the mat-forming grasses.

On the small North Chanter Islet a small population of the grass *Lepturus repens* was found, thus representing a southern extension of this widespread tropical Pacific coral strand species. Its Kermadec locality is in one of the very few places in the group where an old raised coral reef is present. Another tropical herb found on a nearby islet is *Sigesbeckia orientalis* which was last seen in 1908, having earlier been recorded as common. Its origin in the Kermadecs is unknown as is the reason for its decline.

Cook Islands

Work on the flora has been mostly in abeyance because of the priority given to the adventive dicotyledon flora of New Zealand. However, a visit was made to Rarotonga, Mauke and Mitiaro in August and September of 1982 and several more species were added to the flora and others were rediscovered.

On Rarotonga a very small population of an unnamed species of

Sarcomelicope (Rutaceae) and another small population of *Sclerotheca viridiflora* (Campanulaceae) were found. Neither had been seen by collectors since the 1920s. More ferns were found even though the pteridophytes have been better collected and studied than any other group of plants. Most of them grow in the montane forest of the precipitous volcanic peaks and ridges although more Thelypteridaceae were found at low altitudes in deep ravines. The most interesting discoveries were *Ctenopteris blechnoides* (Grammitidaceae), *Polystichum aculeatum* and *Dryopteris* aff. *fatuhivensis* (Aspidiaceae).

One of the main reasons for visiting the Cooks was to study the almost unknown flora of Mitiaro, one of the Ngaputoru Group north-east of Rarotonga. This is a low makatea (raised coral) island with a large central swamp and lake amongst which are three small areas of volcanic soil where the few inhabitants of the island grow their food. There is little indigenous vegetation left there and the swamp mostly supports a dense and uniform growth of *Cladium jamaicense*. Thus, the main botanical interest on Mitiaro is the flora of the extensive makatea. The rough and often jagged and pitted coral supports a vegetation ranging from a sparse open scrub to low forest with a closed canopy, according to the degree of exposure. Because of the inhospitable terrain there has been little disturbance to the flora. The other main islands forming the Ngaputoru Group, Atiu and Mauke, are similar makatea islands but the makatea flora of Mitiaro is distinct and differs from both much more than either do from each other.

Mitiaro is the only island in the Cooks where sandalwood grows, an endemic variety of the East Polynesian *Santalum insulare*. Much more surprising however is the abundant presence of *Haloragis prostrata*, otherwise only known from New Caledonia and Vanuatu. A small unidentified composite appears to be related to *Tetramolopium*, a genus known only from Hawaii and, according to some taxonomists, New Guinea. The low makatea forest of Mitiaro is also ecologically distinct from the other makatea islands in the area with several dominant species being local or absent elsewhere. They include one species in each of the genera *Celtis* (Ulmaceae), *Geniostoma* (Loganiaceae), *Myrsine* (Myrsinaceae), *Phyllanthus* (Euphorbiaceae), *and Planchonella* (Sapotaceae), and the fern *Asplenium polyodon*. Conversely, several genera which are generally very common on similar islands in the region seem to be (rare or) absent from Mitiaro; e.g. *Colubrina* (Rhamnaceae), *Elaeocarpus* (Elaeocarpaceae), *Hedyotis* (Rubiaceae), *Melanthera* (Compositae), and the swamp fern *Cyclosorus interruptus*.

The spread of adventives in the Cooks was mentioned in the 1978-1981 Triennial Report. More species were collected on Rarotonga in 1982, this being the main point of entry for such plants into the Cooks. In the Ngaputoru Group, Atiu and Mauke have a number of weeds which pose serious problems to agriculture in the tropical Pacific. All of these grow on Rarotonga but few are on Mitiaro, the main reason is almost certainly that the latter has never had a cash cropping system with all its attendant introduction of plants and machinery, or the increased amount of open, modified ground available for opportunist adventives to grow in. Thus, *Elephantopus mollis, Mikania micrantha, Pseudelephantopus spicatus, Psidium guajava* and *Stachytarpheta urticaefolia* appear to be absent from Mitiaro, whilst *Hyptis pectinata, Indigofera suffruticosa* and *Lantana camara* are not on Mitiaro and Mauke but are on the more developed Atiu.

TONGA

In May and June 1982 Mr G.P. Buelow of Honolulu collected extensively on the twin volcanoes of Tofua and Kao in the Ha'apai Group of central Tonga. The specimens are deposited in the Botany Division Herbarium but have not been fully studied yet. It is apparent that a number of new records occur, particularly amongst the ferns, most of them constituting an eastward extension of the known range of the species to which they belong. Mr Buelow has prepared an account of all taxa thought to be new for Tonga.

NIUE

A number of species not mentioned in "Contributions to the flora of Niue" DSIR Bulletin 200 (1970) have been collected since then. A joint account of these new records is being compiled with Dr A. Whistler of the Tropical Pacific Botanic Garden in Hawaii. In addition, it is intended to bring the floristic record for Niue up-to-date by including the significant taxonomic changes since 1970. Nearly all the new records are of adventives, several of which have recently become abundantly naturalised, especially in modified areas such as roadsides and in the main villages.

FIJI

In 1983 Dr P.J. Garnock-Jones published a note on folklore drugs and remedies of the Lau Group (*S. Pac. J. Nat. Sci 4*: 4-8) in which he mentions the medicinal uses of 14 plants from Vanua Balavu and Lakeba. The listed uses for most of these plants had not been officially recorded before from Fiji.

THE SUBANTARCTIC ISLANDS

(Miss B.H. Macmillan)

In December 1983 Miss Macmillan joined a private expedition to the Auckland Island group which was arranged by Mrs Pauline Mayhill of Hamilton. A summary of the expedition was given by Audrey Eagle (*Royal Forest and Bird 15*: 14-18). Miss Macmillan made observations on the habit and habitats of *Acaena minor* var. *antarctica* which is indigenous to the Subantarctic Islands. *Acaena anserinifolia*, a mainland species, was first recorded at Port Ross by L. Cockayne and B.C. Aston in 1907. Miss Macmillan found it at the landing sites of Tandy Inlet, and Epigwaitt in Carnley Harbour. At both sites its hybrids with *A. minor* var. *antarctica* were much more vigorous than the species. Specimens were collected for the herbarium.

Dr Peter Wardle participated in the 1984 Lands and Survey Expedition to Campbell Island from 26 January — 17 February and assisted with measurement of quadrats in vegetation protected from and accessible to wild sheep. He also made observations on growth of shrubs and peat, and heat-exchange in plants of different life-form (Botany Division Unpublished Vegetation Report No. 478a).

The appointment of Dr Colin Meurk has brought to Botany Division a wide and detailed knowledge of the Subantarctic Islands from field work commenced in 1970.

PALYNOLOGY AND MORPHOLOGY

(Dr N.T. Moar)

The Palynology and Morphology Section has responsibility for anatomy, cytology, palynology and electron microscopy. Besides developing projects which have links with the work of ecologists and taxonomists within the Division each group establishes contacts outside as is appropriate to their discipline or according to requests for help or advice.

The electron microscope laboratories were renovated about three years ago as part of our policy of upgrading and developing the unit as a regional facility. This policy was further implemented when an order was placed with Zeiss of Oberkochen, Federal Republic of Germany, for purchase of a Zeiss 902 transmission electron microscope to replace our twenty-year-old Hitachi HU-IIB. Zeiss have developed the revolutionary electron spectroscopic imaging system (ESI) commercially and the 902, which incorporates it, provides a sophisticated microscope and analytical instrument expected to satisfy local and regional needs for many years. Sister divisions at DSIR Lincoln, the Wool Research Organisation, and the Ministry of Agriculture and Fisheries supported the purchase of the instrument.

We currently have access to a Cambridge 502 scanning electron microscope with analytical capability, at the Botany Department, University of Canterbury. DSIR staff at Lincoln have been encouraged to learn to use the instrument and demand for time on it is high. A long-term aim is to add a scanning electron microscope to the electron optics unit at Lincoln.

In palynology our major effort has been restricted to pollen analysis of Quaternary sediments and to pollen morphology. Nevertheless we monitor literature in many areas of palynological endeavour to enable us to better answer queries or offer comment as the occasion demands. Work in the Quaternary still draws most enquiries, although there is a demand for work in melissopalynology. Completion of the Pollen Atlas (pollen morphology) will encourage others to undertake pollen analysis for themselves with greater confidence than is presently possible.

Quaternary studies have developed to the stage when the first objective, that of understanding patterns of change in the post-glacial and the late-glacial, has been realised. We can trace patterns and trends in vegetation history, we have drawn firmer conclusions about climate history, and have begun to understand something of the history of individual species or genera. In this context we have already discussed the implications of the so-called *Ascarina* decline, have commented on the role of *Nestegis* in the last interglacial and have accumulated considerable data on the history of *Nothofagus* and other forest genera during these times.

The need for detailed regional studies continues — we know little of the post-glacial in Northland, our understanding of interstadials and their characteristics is still limited, and vegetation patterns in the last interglacial are known from only a relatively few sites. Nevertheless, there is now a need to examine trends and patterns in greater detail in order to develop clearer insights into the processes affecting succession during periods of change in the past. This may be achieved in a number of ways, including

fine resolution pollen analysis, by a more quantitative approach to the treatment of our basic data, and by the application of computer programmes to the handling of our data.

During the last three years we have made progress in these areas, more especially with data processing. We are now using a programme developed by palynologists in the New Zealand Geological Survey with which pollen diagrams can be produced from raw counting data in a matter of minutes. This programme is of wide application and has also been used to produce tables of pollen frequencies following pollen analysis of honey. To further our capabilities in this field we are buying POLSTA, a programme devised by Dr Green, Department of Biogeography and Geomorphology, Australian National University, Canberra.

Fine resolution pollen analysis has promise for our Quaternary studies in the period spanning the last 12 000 years or so. Of particular interest in this regard are the important transitions grassland-shrubland, shrubland-forest, the interplay between species in the forest phase of the post-glacial, and the changes reflecting recovery from the effects of volcanism or the fires of Polynesian and European times. Dr McGlone has already made some use of close sampling, but the very close continuous sampling of northern hemisphere practitioners has yet to be implemented.

Quantitative pollen analyses have been a characteristic of melissopalynology and are being increasingly used for Quaternary studies. The method used is a simple one in which a known weight or volume of a sample is spiked with *Lycopodium* tablets.

For the latter half of the period under review the palynology laboratory was closed for renovation because of failure of the exhaust system used in the fume cupboard. This difficulty, now corrected, resulted in the accumulation of samples, including some from the Subantarctic Campbell Island, which are now being cleared.

Studies in wood anatomy have continued. Of special interest is the completed work on the anatomy of the bark of indigenous species of *Nothofagus* and a re-examination of their wood anatomy is now almost finished. Our anatomist, Mr R.N. Patel, is often asked to identify wood samples for a variety of reasons, including requests involving forensic matters.

Cytological work has generally been directed towards routine chromosome counts and a drawing together of results relating to the cytology of New Zealand podocarps. The basic work for this was carried out some 25 years ago by the late Dr J.B. Hair and Mr E.J. Beuzenberg, and was recently taken up again for completion and publication by the latter.

WOOD ANATOMY

(Mr R.N. Patel)

Systematic study of the wood anatomy of the indigenous dicotyledonous shrubs and trees has continued. Anatomical descriptions of Elaeocarpaceae, Cunoniaceae, Loganiaceae and Gesneriaceae have been completed.

The anatomy of the woody species of the Araliaceae is being examined.

In New Zealand the family comprises *Schefflera* and *Meryta* each with one species and *Pseudopanax* with 14 species. In *Pseudopanax* the vessel characteristics have diagnostic and to some extent taxonomic value. These characteristics include perforation plates, inter-vessel pits, spiral thickening, vessel-ray pits and vessel distribution. For example, an examination of several thousand isolated vessel elements indicates that some species (e.g. *P. arboreus, P. colensoi*) have mostly simple perforation plates while the others (e.g. *P. simplex, P. edgerleyi*) have mostly scalariform perforation plates. Vessel elements with a simple perforation plate at one end and a scalariform plate at the other end were found in all *Pseudopanax* species. Such vessel elements were fairly frequent in a few species (e.g. *P. linearis*). Not one species of *Pseudopanax* showed exclusively one type of perforation plate. Features of rays and fibres also contribute towards the separation of species.

The work on the bark anatomy of the species of *Nothofagus* native to New Zealand has been written up (*N.Z. J. Botany 3*: 511-532) and the wood anatomy of these species is nearly complete.

About 365 wood samples were identified for various inquirers throughout New Zealand. Recently Forest Service staff systematically collected 150 samples from a buried forest at Pureora in the West Taupo district. A plantation of *Pinus contorta* had been clear-felled in the area before draining of the bog in preparation for planting in *Pinus radiata*. The draining operation exposed the buried forest which grew before the Taupo eruption of approximately 130 A.D. The logs are covered by Taupo tephra to varying depths of up to one metre. Most wood samples sent in for identification were in an excellent state of preservation while a few were charred. The identifications showed that the site concerned was a podocarp forest with rimu, *Phyllocladus* and matai as major components. The presence of compression wood, a naturally occurring defect, made identification of several conifer samples very difficult. A few dicotyledons, e.g. *Nestegis, Myrsine, Pseudowintera, Metrosideros*, were also identified among the samples of the buried forest.

CYTOLOGY

(Mr E.J. Beuzenberg and Mr M.I. Dawson)

A miscellany of chromosome counts are published in numbers 23 to 28 of the Chromosome Atlas series, and includes *Abrotanella, Acaena, Coprosma, Muehlenbeckia, Myrsine, Olearia, Ourisia* and *Ranunculus*. Six genera in Myrtaceae and 22 genera in Orchidaceae are currently under investigation. Earlier cytological work on the Podocarpaceae (see Triennial Report 1957-59, 1960-62, 1963-65) was resumed, and the results are now being collated for publication.

QUATERNARY BOTANY

(Dr M.S. McGlone and Dr N.T. Moar)

Demand for pollen analytical work has continued to increase. Geologists and geographers working in the area of Quaternary research have been particularly interested to have pollen results from their field areas; much work has stemmed also from studies by archaeologists and field ecologists. The lack of a strong university presence in pollen analysis has meant that much of this demand is being met by DSIR pollen analysts.

At present Dr McGlone is investigating a total of 22 sites in conjunction with some 25 geologists, botanists and archaeologists. Since the last Triennial Report he has assisted with the supervision of two M.Sc. and two Ph.D. projects and provided palynological information for several other dissertations. Because of this service commitment, the actual areas being investigated have depended to a large extent on areas actively being worked on by other Quaternary researchers. This has been useful, as basic pollen analytical information is scarce in most regions.

Dr McGlone's research has been undertaken in four main areas: 1. vegetation history; 2. effects of volanic eruptions; 3. effects of Polynesian burnings; 4. quantification of pollen-climate relationships.

1. VEGETATION HISTORY

The major effort has been in the central North Island, following on from work done for Dr McGlone's Ph.D. dissertation. Long pollen diagrams have been published for the Tongariro region, Gisborne — Bay of Plenty and lowland Taranaki. Other completed work on the Waikato Basin, Taranaki and Hawkes Bay awaits publication. Further work is being undertaken on older sequences throughout this region.

A major result is that the structure of the Last Glacial and Last Interglacial has become much clearer. There were two major cold stadials centred on 18,000 and 65,000 years ago respectively. There was a prolonged cool interstadial separating these stadials from about 25,000 to 60,000 years ago, during which shrubland-grassland was dominant in the west and centre of the central North Island, and forest and shrubland clad the Bay of Plenty — Gisborne regions. What was once conceived of as a long single event, the "Last Interglacial" is proving to be very complex. On Ruapehu, two forested episodes preceded the cooling to full glacial conditions at 70,000 years ago, and possibly three such episodes are recorded in a deep core taken from Lake Poukawa in Hawkes Bay. These "warm" forested episodes are separated by cooler, partially forested episodes. Absolute dates of these events have not been determined, but at present they are correlated with substages of the oxygen isotope stage five which spans the period 70,000-125,000 years ago.

Post-glacial pollen results from the central North Island support the concept of a mild early period followed by climatic deterioration. Between 10,000 and 7,500 years ago, *Nothofagus* was rare, *Phyllocladus, Libocedrus, Knightia* and several other trees absent or uncommon and, perhaps most importantly, *Agathis* was absent in the pollen rain. Since 7,500 years ago, all these taxa have increased while *Dacrydium cupressinum, Metrosideros* and

Ascarina, abundant previously, have generally declined. These changes are attributed to a general deterioration and increasing continentality of the climate after a mild, wet early post-glacial. It seems that an increasingly southerly and south-westerly wind flow pattern underlies these climatic alterations.

No further progress has been made in the Southland-Otago region, except that several cores have been taken from Stewart Island and preliminary pollen diagrams analysed. The Stewart Island vegetation history is very distinctive, and it appears — in contrast to the nearby mainland — that there was no early post-glacial *Podocarpus spicatus — Dacrycarpus* dominant forest phase.

2. Effects of Volcanic Eruptions

A total of seven central North Island sites are being investigated to find out how and for how long eruptions from the andesitic and rhyolitic volancoes of the area affected the vegetation. Results to date suggest that reafforestation has been extremely rapid after both andesitic and rhyolitic eruptions. There is no basis for believing that there have been any permanently treeless areas as a result of volcanic devastation. However, an unexpected result has been that forests, remote from centres of rhyolitic volcanism, show distinct fire-caused perturbations lasting for about 100-200 years after an eruption. Ash falling more than 50 km away from the centre of a rhyolitic eruption is cold. Cycles of fire following ash fall cannot therefore be ignited directly by the eruption. An explanation may be that rainout of noxious chemicals may have caused widespread foliage death, and so enhanced fire risk.

3. Effects of Polynesian Burning

In 1983 a review paper was published on this topic. Since then several more sites have been investigated in the north of the North Island. Without exception, the established pattern of very rapid burn-off of forest vegetation has been found at each site. Dates for substantial forest destruction now range between 900 years ago to 400 years ago. In Northland, north of Kaitaia, forest destruction was unusually complete and some species, including *Ascarina lucida* and *Nothofagus truncata,* probably became locally extinct during the Polynesian burning phase.

4. Quantification of Pollen-Climate Relationships

In 1983 a joint NZ-British-American project on the quantification of NZ pollen-climate relationships was initiated by an international group COHMAP (Climates of the Holocene Mapping Project). With the aid of a grant from NERC (National Environment Research Council) of Britain, David Norton and Tom Wigley of the Climatic Research Unit of the University of East Anglia, collaborated with Botany Division pollen analysts on this pilot project. A large number of modern pollen rain sites were collated in New Zealand and the data sent to the University of East Anglia. Pollen values were statistically compared by multiple regression techniques with rainfall and temperature figures. Significant relationships were discovered, and transfer functions, which enable fossil pollen data to be directly translated into annual temperatures and rainfall, were calculated. At present, the data base is too variable and too patchy in its coverage

for the transfer function results to be applied to fossil data. At the moment, other commitments prevent further work on this project but the potential of the method has been firmly established.

Work in the South Island by Dr N.T. Moar has been based for the most part in north Westland and has been concerned with interpretation of pollen diagrams derived from cover beds overlying glacial outwash gravels, organic silts buried within outwash gravels and post-glacial sediments from an in-filled kettle hole.

As data accumulated it became clear that earlier interpretations, based on limited sites, required revision. The validity of radiocarbon dates obtained from the cover beds was suspect because obviously different pollen diagrams were derived from sites which spanned a similar time range. The sequence, rimu forest — beech forest — rimu forest known from Blue Spur Road, already described, and other sites yet to be published contrasts with the shrubland — grassland — rimu forest sequence recorded from Wilson's Lead Road and from Graham Terrace, a site only recently studied. This last does not compare completely with the post-glacial transition from grassland through shrubland to forest in north Westland. Indeed the only characteristic common to every pollen diagram is the record of post-glacial rimu forest in the upper layers of sediment.

Difficulties associated with radiocarbon dates were emphasised when Kawakawa tephra was identified in the coverbeds at Graham Terrace. This tephra, derived from the central North Island, has a well documented radiocarbon age of 20,000 years B.P. and provides the only reliable time plane for north Westland coverbeds.

These considerations have led to the present view that the coverbeds accumulated at different times, and at different rates, regardless of the age of the underlying gravels. Further, the rates of sedimentation have been so slow at some sites that the patterns of vegetation change are not easily recognised and this accounts for the apparent contradiction of forest at one site and grassland at another. In biostratigraphic terms the Blue Spur Road and similar sites are therefore now thought to be representative of late Oturian/early Otiran sequences rather than middle to late Otiran sequences as suggested by radiocarbon dates.

The data also provides an insight into the history of *Nothofagus* in north Westland. In view of present understanding *Nothofagus* is believed to have been an important element in the vegetation of the area, south to Hokitika during the early to middle Otiran, and that later, its role in the vegetation there was considerably reduced.

MELISSOPALYNOLOGY

(Dr N.T. Moar)

The pollen analytical study of New Zealand honey is completed and the results are due for publication in 1985. We now retain a lower-key interest in this topic and will examine honeys not previously studied, or if other reasons e.g. forensic needs, demand it. There is a continuing interest

in the identification of pollen grains included in bee loads as they forage for pollen. This interest is expressed by those involved in pollination problems or by apiarists wishing to export pollen pellets for health-food purposes. Some interesting botanical results are obtained, and recently examination of pellets taken by entomologists from a native solitary bee, *Hylaeus relegatus* on Banks Peninsula, showed that *Phormium tenax* (New Zealand flax) and *Alectryon excelsa* (titoki) pollen was favoured over others. *Coriaria* (tutu) pollen was also present, 32% and 16% respectively in each of two pellets, the largest quantity from this genus yet identified in bee loads.

POLLEN MORPHOLOGY

(Dr N.T. Moar)

Efforts in pollen morphology have continued towards completion of the Pollen Atlas, and nomenclature and descriptions are now being checked for consistency of detail and presentation. The basis for the Atlas is still Volume I (1961) of the New Zealand Flora series, but subsequent changes in taxonomy or nomenclature have to be taken into account. Any such changes accepted by Botany Division taxonomists and incorporated in the herbarium are adopted for the Atlas. This sometimes involves preparation of further pollen slides to take these into account.

There remains a continued demand for help with pollen identification. An interesting trend during the last few years is the desire for increased self reliance in this respect, especially for pollen analysis. The publication of the Pollen Atlas will help this need more especially for Quaternary pollen analysis, and other atlases useful to apiculturists and aerobiologists are desirable.

CELLULAR BOTANY

(Dr M.N. Philipson)

During an embryological study of certain grasses, a benign fungus was discovered in the embryo sac of the North American poverty rat-grass (*Danthonia spicata*). This discovery encouraged us to look for and successfully locate an endophyte in the embryo sac of perennial ryegrass (*Lolium perenne*). A search of the literature showed that knowledge of a fungal invader of the embryo sac of *Lolium perenne* had existed for more than sixty years but for some reason this knowledge and therefore its implications had been overlooked. When infected with an endophyte, perennial ryegrass is the cause of several neurological diseases of grazing animals. One of these, known as ryegrass staggers, is of particular concern in New Zealand and because of its serious nature, the emphasis of our work shifted — elucidation of the relationship between fungus and host in *Lolium perenne* and *Danthonia spicata* was given priority over other projects.

An Epiphytic/Endophytic Fungal Associate of *Danthonia spicata*

The fungus formerly associated with *D. spicata* was identified as a species of *Ephelis* by Dr Gary Samuels of Plant Diseases Division, Auckland. The organism is endophytic only during the flowering period of the host grass. During the vegetative phase of the host, the fungus is located on the surface of the shoot apex and at the base of rudimentary leaves where it lives as an epiphyte. With conversion of the shoot apex to the floral initials at the onset of flowering, the fungus becomes enclosed by floral initials so that at an early stage of development it is detectable within the ovary cavity and between ovular layers such as the outer and inner integuments. In this location it may be described as endophytic. A weft of fine white fungal hyphae on the outside of the ovary and over stamens and styles is readily detectable under the dissecting microscope. Within the ovary hyphae require staining to be visible under the light microscope. In the ovule the fungus remains outside the megagametophyte until fertilisation has been effected and the first few divisions of the zygote have occurred. Entry to the embryo sac then probably occurs through the degenerate synergid, and hyphae soon come to lie on the embryo surface and on the embryo sac wall. The fungus remains as a benign intruder in the embryo sac while embryogenesis proceeds. It eventually takes up its position on the shoot apex when this becomes differentiated. Growth of the coleoptile over the apical surface encloses this fungus, and on embryo germination, the fungus on the shoot apex is returned to an epiphytic existence. In this organism, which we call a fungal associate rather than an endophyte, sporulation has been conclusively observed only in culture.

Long filaments have been seen under the electron microscope and these are unusual in their possession of a thick mucopolysaccharide outer cell wall apparently similar to that of unicellular encapsulated yeasts. The only time the "capsule" was found to be much reduced, occurred when hyphae entered non-starchy endosperm cells, directly concerned with the nutrition of the embryo, adjacent to the developing embryo.

Nothing is known of any mutual benefit or otherwise of the *Danthonia spicata*/fungus relationship. This is in direct contrast to the *Lolium perenne*/ fungus association where resistance to certain insects e.g. Argentine stem weevil, is conferred on the host plant by the endophyte.

The Endophyte of *Lolium perenne*

The relationship of endophyte and ryegrass in the vegetative phase has already been extensively studied. Our observations elucidated the relationship existing during the flowering and seed-set of the host plant.

Unlike the *Danthonia* fungal associate, the *Lolium* fungus is a true endophyte, ramifying between cells mostly of the leaf sheaths. Hyphae present between cells of the shoot apex in the leafy stem grow between those of the floral axis and its initials on conversion to flowering, and so are present in the developing ovary and ovule from the earliest stages of development. Before the megagametophyte matures the hyphae invade ovular tissues and congregate in a zone of nucellar degradation outside the area of attachment to the megagametophyte wall of the three large antipodal cells. These cells are the point of entry of the endophyte into

the embryo sac, for hyphae invade them soon after fertilisation when the first few divisions of the zygote have occurred.

As in *Danthonia* the fungal invader of the embryo sac does not immediately penetrate the tissues of the young embryo. In *Lolium*, the endophyte was first observed at the 'notched' stage, when the shoot apex was becoming differentiated. Hyphae commonly appear to enter between epidermal cells at the micropylar end of the embryo, and occasionally, intracellular penetration of these cells occur. In all such cases, however, the endophyte lies between host cell wall and plasmalemma, without penetration of the cytoplasm. By the time the embryo is fully differentiated, the endophyte is widespread except in the region of the root apex which is usually sparsely infected or not at all. Infection of the shoot apex and mesocotyl may be relatively light, but it is always heavy in the scutellum. Many hyphae lie outside the embryo, below the testa and between aleurone cells. Starchy endosperm cells are free of the endophyte.

The belief that invasion of the embryo occurs at germination is shown by this study to be incorrect, for the germinating seed already carries the endophyte between cells of the shoot apex. Leaf initials are therefore successively infected as they are formed during the vegetative phase of the ryegrass life cycle.

Despite the fact that the fungi associated with *Danthonia spicata* and *Lolium perenne* have the same remarkable ability to be transmitted to the next generation by way of the embryo sac, our investigations have shown that they are otherwise distinct.

Nectaries

Nectary studies were continued to clarify some points in the development of the rata nectary, and to investigate the development of crystals apparently associated with this tissue. Druses are prevalent in these nectariferous cells from their earliest development and histochemical techniques have identified them as calcium oxalate. When first formed, the crystals are associated with membranes from which they seem to be deposited. Confirmation is being sought that these membranes originate at nucleation sites within masses of flocculent material present in cell vacuoles. We expect that the higher resolution of the new TEM will assist in the elucidation of crystal-membrane development.

Flavour and Lachrymatory Precursors in *Allium*

A study of the ultrastructure of the *Allium* (onion) cotyledon is being undertaken in co-operation with Applied Biochemistry Division colleagues who have been investigating flavour and lachrymatory precursors of this plant. Studies have been made of cotyledons germinated in the light and in the dark, on mature leaves and on storage bulbs. Light-germinated cotyledons are of particular interest as they indicate that cisternal endoplasmic reticulum (ER) produces numerous vesicles from any position along its length. Many membrane-bound spiral polyribosomes are associated with the endoplasmic reticulum. Future work on this project will involve the analytical mode of the new microscope in order to determine whether ER vesicles produced in the cytoplasm contain the precursor of the tear-inducing compound, (S-trans-prop-1-enyl-L-cysteine sulphoxide) which it

is reasoned, is compartmentalised until cell disruption exposes it to the action of the enzyme alliinase, believed to be present in the cell vacuole.

Embryology

During the investigation into the relationship between the grass *Danthonia spicata* and an associated fungus, a curious feature of the grass ovary was occasionally found to occur. Previous investigators reported that a pore is formed between the styles in the course of development of the grass ovary. This pore normally closes but in the observed cases where the fungal associate becomes enclosed in the ovary it remains open, presumably because of the fungal hyphae which freely traverse it. In addition to hyphae, ribbon-like structures were sometimes seen to project through the pore. The ribbons were of variable length and their large cells were highly translucent. Usually one ribbon was observed, but less commonly, a second, shorter ribbon was present.

These ribbons formed as an outgrowth from the outer surface of the outer integument. Occasionally however, the margin of the primordium of the integument became deflected into the pore to form the projection. A second ribbon was seen to be a development of tissue from the inner integument. These protrusions, which were usually enveloped in a weft of fungal hyphae, were not present in all florets of a spikelet, nor in all spikelets of a panicle, but were quite common in a number of plants in a small population. As they were not observed in plants free of the fungus, it was assumed that the fungus was responsible for the development of this curious teratological growth.

Haustorial Synergids

In the previous Triennial Report, haustorial synergids were found to occur in *Cortaderia* and *Lamprothyrsus*, members of the Subfamily Arundinoideae of the Gramineae. Extension of this study to investigate the presence of these rare embryological features in other members of the subfamily established them in the tribe Danthonieae but not in two of the three genera of the tribe Arundineae (*Arundo phragmites*) in which *Cortaderia* has traditionally been included.

Arundo and *Phragmite* were found to possess typical, pyriform graminoid synergids in contrast to the extended synergids which were a feature of the third genus *Cortaderia*. Thus, similar embryological features, together with austral distribution and the tussock habit, which are features of the tribe Danthonieae, favour the transfer of *Cortaderia* from the Arundineae to the Danthonieae.

PLANT ECOLOGY

(Dr I.A.E. Atkinson and Dr P.A. Williams)

The triennium has seen a steadily growing demand on the Division's ecologists to contribute to and criticise drafts of district and regional schemes, farm development proposals, land-management plans and policies, mining applications, transmission-line and pipeline routes, water conservation

orders, and amendments to Acts of Parliament, as well as other environmental matters including environmental impact reports and assessments, and Town and Country planning hearings. In the 18-month period between July 1983 and December 1984, Botany Division made 107 submissions (1.5 per week) on environmental impact reports, assessments and related matters. Co-ordination of submissions from individual scientists within the Divison has been greatly assisted by the appointment of Miss Sue Gamble as Advisory Officer. Nevertheless, although scientific input into land management decisions is a necessity, a more efficient way of doing this will have to be found if the research function of the Division is not to be jeopardised. Intensive research is essential if real understanding of environmental problems is to be achieved. Divisional ecologists have also been co-operating extensively with staff of the Biological Resources Centre in delineating and describing a national system of Ecological Regions and Districts, as well as supervising some of the rapid surveys associated with the Protected Natural Areas Programme. The Division's own effort to secure representative reserves has also proceeded unabated. Cataloguing and standardising the Division's unpublished vegetation reports has made a large body of information more readily available, as well as enabling requests for information to be met more readily. Reports written up to the end of 1984 total 510, with 133 having appeared during the 1982-4 triennium.

THE VEGETATION OF NEW ZEALAND

There is a growing awareness of the uniquely New Zealand character of our vegetation, flora and associated landscapes. Planners and land managers, as well as ecologists and educators, need a new comprehensive account of the vegetation of New Zealand. The last such account was published in 1928, and since then both our understanding of the vegetation and the vegetation itself have changed greatly. Work so far has consisted mainly of compiling a bibliography, and filling in gaps in field knowledge; the latter is being achieved in the course of meeting Botany Division's commitments with respect to vegetation survey (Dr Wardle).

BIOLOGICAL SURVEYS OF SCENIC AND ALLIED RESERVES

Progress continues with 8 regional surveys now published and 5 awaiting publication. The information recorded provides a basis for managing individual reserves and is essential in helping to identify gaps in the reserve system where further natural areas are needed to protect natural communities that are not already protected.

NORTHLAND

The reserves of Otamatea and Whangarei counties, and some in the Bay of Islands, have been surveyed and draft reports prepared for the majority. Reserves are being surveyed county by county to co-ordinate with management plans being prepared by the Department of Lands and Survey (Dr Clunie).

South Auckland

With the assistance of the Department of Lands and Survey S.E.S. workers, a survey has begun of reserves in the South Auckland Land District. Work to date has been concentrated in the Waikato Ecological Region and the Rotorua Lakes Ecological District with surveys of more than 50 scenic reserves now completed (Dr Clarkson).

West Gisborne

Mrs B.R. Clarkson was appointed temporarily to carry out the Biological Survey of the West Gisborne Reserves. This survey was completed in November 1984 and awaits publication by the Department of Lands and Survey. Twenty-two reserves covering a total of 28,850 ha were surveyed, including Waioeka Gorge, the largest scenic reserve in New Zealand. The main vegetation types represented were tawa-dominated broadleaved forest and beech (hard, black, red and silver) forest. Coastal vegetation was poorly represented and priorities for reservation were identified. Additional information on the distribution and abundance of threatened native plants such as *Bulbophyllum tuberculatum* and *Myosotis petiolata* var. *pottsiana* was gained (Mrs Clarkson).

East Taranaki

Scientific supervision was given to the Biological Survey of Reserves of East Taranaki led by Mrs M. Bayfield, Department of Lands and Survey, New Plymouth. This survey was completed in March 1984 and awaits publication by the Department of Lands and Survey. Sixty-nine reserves covering a total of 12,193 ha were surveyed. The main vegetation types represented were tawa-dominated broadleaved forest and beech (hard and black) forest. Coastal, semi-coastal and wetland vegetation were under-represented and priorities for reservation were identified. New records of the threatened shrub *Teucridium parvifolium* and the regionally uncommon small tree *Ascarina lucida* were made (Dr Clarkson).

Marlborough Sounds

All 96 reserves of the mainland and those of inner and outer islands were surveyed and the results published by the Department of Lands and Survey in mid 1984. Reserves account for almost one-third of the land area in the Marlborough Sounds, including sequences from coastline to alpine tops. Most reserves contain native broadleaved and beech forests, and regenerating native vegetation where past modification has occurred. They also conserve low open vegetation on ultramafic soils, the only alpine vegetation in the Sounds, inland valley systems, sea cliffs, seabird colonies, archaeological and historical sites, wildlife refuges, and rare and endangered plants and animals. Not adequately represented in reserves are estuarine communities and other wetlands, low-altitude forests of tall podocarp and broadleaved species on valley floors and coastal flats, and ultramafic communities. Fencing and animal control, especially of feral pigs, goats, deer and possums, are the main management requirements. Of the weeds, self-sown exotic pines are the greatest current threat to native vegetation, and old man's beard (*Clematis vitalba*) may become a local problem.

Partly as an extension of this survey a paper will be published in 1985,

Collection details from herbarium specimens are entered into the CHIRP data bank by Ms J. Glasson.

Dr. W.G. Lee surveys alpine vegetation around an alpine tarn in central Fiordland.

Botany Division Staff and Associates on the occasion of the retirement of Dr E.J. Godley, May 1984

Back row — K.K. Pandey* D.R. Given C.J. Webb P.J. Garnock-Jones R.W.J. Knox A.E. Esler M.K. Reynolds A.J. Fife R.N. Patel R.M. Greenwood†† I.C. Brown W.R. Sykes

Third row — P.A. Brooke L.J. Mather S.J. Taylor M.E. Taylor P.J. Clark J.B. Francis M.D. Stolp S.J. Gamble J.E. Shand J. Glasson L. Nesbitt V.E. New B.P.J. Molloy A.D. Thomson

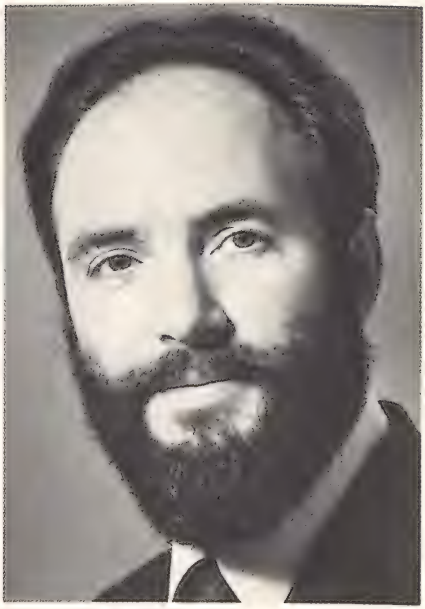
Second row — P.C.M. Douglass M.N. Philipson. M.B. Ferde* P.A. Williams P. Wardle W. Harris L.B. Moore** E.J. Godley W.M. Hamilton† E. Edgar N.T. Moar U.V. Cassie B.H. Macmillan

Front row — J.V. Myers A.W. Purdie T.R. Partridge P.N. Johnson R.B. Allen M.I. Dawson R.P. Buxton M.J. Parsons

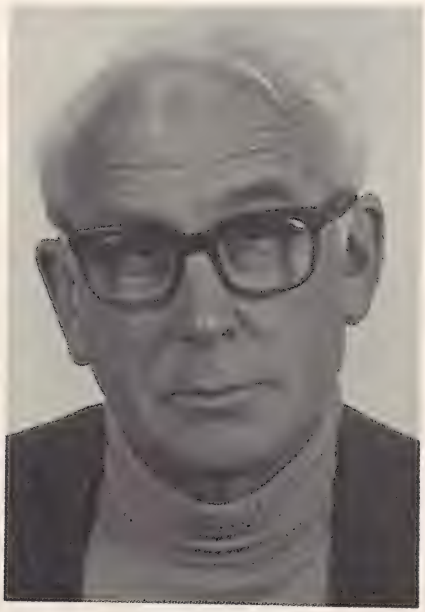
Absent scientific and technical staff — I.A.E. Atkinson E.J. Beuzenberg M. A. Bloomfield M.J.A. Bulfin B.D. Clarkson N.M.U. Clunie A.M. Hodgins G.C. Kelly W.G. Lee M.S. McGlone D.J. Purcell K.J. Stewart G.Y. Walls

* Grasslands Division DSIR; ** retired from Botany Division; † Former Director General of DSIR; †† retired from Applied Biochemistry Division, DSIR

Mr A.P. Druce



Dr D.J. Galloway



Dr E.J. Godley

Dr H.E. Connor

in conjunction with M.D. Laffan (N.Z. Soil Bureau), on the vegetation and soil patterns of the Marlborough Sounds (Mr Walls).

Southern Marlborough

"Scenic Reserves of Southern Marlborough" was published by the Department of Lands and Survey in 1982. Most reserves are on steep land along the coast. Among the most important reserves are Isolated Hill, with fascinating limestone gorges, and two reserves in the Kaikoura Ranges. Mount Uwerau supports breeding populations of shearwaters, while Mount Tapuaenuku includes the highest peak in New Zealand outside of the Main Divide. There are vast areas of inland Marlborough with no reserves and this is a priority area for survey (Dr Williams).

Nelson

Survey of scenic reserves of Nelson is being completed serially, in order to have the finished reports available for use before publication. Fifty reports have been sent to the Department of Lands and Survey. They cover areas ranging in size from 1 ha to 5,400 ha, and include places of high biological interest and diversity. Notable among these are: the Aniseed Valley (or Hackett) Reserve, where old limestones abut ultramafic rocks as well as sandstone, and the vegetation pattern is strongly influenced by rock type; and Mt Courtney in the Buller suite of reserves, where fragments of primeval pakihi forest survive on Pleistocene terrace remnants high above the Buller River (Mr Kelly).

Southland

The 52 scenic and allied reserves of Southland have been surveyed and the results await publication by the Department of Lands and Survey. The Southland Land District is now a largely cultural landscape and very few reserves have been established on highly productive soil. Lowland red-tussock land, for example, covered vast areas of the Southland lowlands up to 40 years ago, but such communities now account for only 0.1% of the total area reserved. The opportunities for reserving red-tussock land and other lowland reserves are diminishing rapidly (Mr Allen, Dr Lee, Dr Johnson).

VEGETATION SURVEYS AND TECHNIQUES

Included here are a number of reconnaissance and more detailed vegetation surveys carried out on particular kinds of communities or on areas of particular interest. Studies such as these provide the primary botanical knowledge of New Zealand and form the basis for commenting on land use planning including reserve acquisition.

National Inventory of Sand Dune Vegetation

Plant communities on sand dunes are among the most threatened in New Zealand; housing development, sand mining, roading, reclamation, rubbish disposal and invasion by introduced plants are some of the threats. The

Division has surveyed virtually all the sand dunes of New Zealand with a view to determining which areas should be reserved. The inventory is being co-ordinated by the Dunedin Office and will be published in two volumes, that for South Island being virtually complete (North and South Island Ecology Sections).

Botanical Surveys in the Aupouri and Te Paki Ecological Regions

This has involved botanical inventory and assessment to identify requirements for nature conservation on Crown Land. The major areas of survey have been the Ahipara tablelands and Tauroa Peninsula, the Kaimaumau wetlands, the Karikari Peninsula, and Te Paki Farm Park (Dr Clunie).

Tongariro National Park

Publication of a 1:50,000 scale vegetation map of the Park was completed at the beginning of the triennium and represents the first stage of publishing the results of this survey. The method of deriving the mapping units separated in the survey has now been published. This should make it possible for future workers to monitor changes in the vegetation pattern in a comprehensive manner. A vegetation classification, associated with the survey, has been refined and widened in scope so that it can be applied to a wide range of terrestrial vegetation in New Zealand (Dr Atkinson).

Chatham Islands

Earlier extensive fieldwork to identify areas suitable as reserves has been brought together into an interpretive map and extended legend, published in the Land Inventory Series. Remaining areas of indigenous vegetation are mapped, and ranked into four grades according to their intrinsic botanical quality, and importance to a representative reserves system. The text includes an outline of 17 vegetation types, and discussion of the biogeographic significance of the Chatham Island vegetation, both based on the earlier reserves report. The 121 mapped sites are crudely characterised. This map complements the 1984 report on Conservation of Chatham Islands Flora and Vegetation, by Given and Williams (Mr Kelly).

Most of the botanically important localities on Chatham Island were visited in January 1982, ten years after the previous survey. All the endemic plants and thirteen vegetation types were assessed for the adequacy of conservation. Most vegetation types except karaka (*Corynocarpus laevigatus*) forest are poorly represented in existing reserves. Many new reserves are recommended, but security for Chatham Island vegetation and flora is dependent on reserving a large area of the Southern Tablelands and coastal cliffs. This area has a diverse vegetation with lowland peat domes and rush-shrublands of *Sporadanthus traversii* and *Olearia semidentata* (Dr Given, Dr Williams).

Native Bush Remnants of the Moutere Gravels, Nelson

This is a discrete area of the Nelson lowlands, forming an undulating series of hills and valleys, etched from early Pleistocene glacial outwash gravels in a tongue-shaped depression between Nelson Lakes and Tasman Bay. The vegetation patterns prior to the first human arrival and at the time of early European settlement have been reconstructed, and compared

with the forest remaining in 198 discrete remnants, in an account published by Botany Division. Of the original forests which covered most of the Moutere Gravels, about 80% has been lost, mostly during European settlement. Most of the surviving bush remnants are small, privately-owned and deteriorating through the pressures of domestic stock, tree cutting, effects of climate, weeds and pathogens. This loss highlights the need to conserve what remains, and the report identifies priority areas for a representative reserve system. At the southern end of the Gravels is a large tract of State Forest, a mosaic of mainly beech forests, which is by far the best remnant. It has been the subject of Ecological Area proposals put forward in late 1985 to the Protected Areas Scientific Advisory Committee (Mr Walls).

Botanical Surveys of Limestone Vegetation in Northern South Island

There are only a few plant species in New Zealand restricted to soils derived from limestone, but the composition of vegetation on limestone always differs strikingly from that on other adjacent rock types. The main areas of indigenous vegetation on limestone in northern South Island are in the mountains of Marlborough and north-west Nelson. These areas have now been extensively traversed and draft accounts of the flora and vegetation prepared (Dr Williams, Mr Druce).

Vegetation of the Inland Kaikoura Range, Marlborough

The Inland Kaikoura Range covers approximately 75 km^2 and includes Mount Tapuaenuku, the highest peak in New Zealand outside of the Southern Alps. This area is the centre of distribution of many species endemic to the north-eastern South Island. A draft account of the vegetation has been prepared and includes seven areas recommended for reservation (Dr Williams).

Wetlands in Canterbury

Conservation of wetlands has received much publicity of late. Formerly regarded as unsightly nuisances, such areas have many unrecognised botanical and wildlife values, and contribute to land stabilisation and water conservation and supply. Around lowland Canterbury attempts are being made, in conjunction with various organisations, to protect, and in some cases restore, wetland vegetation. A study of the diverse Lake Ellesmere shoreline has been prepared in conjunction with the local Catchment Board. Restoration and management of estuarine and freshwater wetlands of Christchurch City is being attempted and monitored, and planting of native species to stabilise eroding shorelines is being undertaken, in conjunction with MAF (Dr Partridge).

Botanical Surveys in South Canterbury

Since the survey of scenic and allied reserves in Canterbury was completed in 1972 by Mr G.C. Kelly, survey work in south Canterbury has focussed on additional plant communities with reserve potential. Surveys now completed include coastal vegetation from Kaitorete Spit to the Waitaki River, as part of a New Zealand-wide survey of coastal sand dunes, and floristic surveys of major ranges in the region, e.g. Mt Somers, Mt Peel,

Four Peaks, Two Thumbs. The first three of these ranges support existing reserves, but significant extensions and new reserves are proposed. The Two Thumbs Range is also part of two PNA surveys, one — Mackenzie — was completed in 1984, the other — Heron — was undertaken in 1984-85 (Dr Molloy).

THE FOREST AND SCRUB OF OTAGO PENINSULA

This Botany Division publication describes the remaining areas of woody vegetation on the Otago Peninsula. They are ranked for scenic, botanical, wildlife, recreational and soil conservation values (Dr Johnson).

THE VEGETATION OF THE DUNEDIN TOWN BELT

This Botany Division publication describes the vegetation of the Dunedin Town Belt and suggests management possiblities (Mr Allen, Dr Johnson).

COMPUTING

The Division is now making much greater use of computer technology. As well as general use, such as that of statistical programs for data analysis, various projects have involved obtaining and managing software specifically for botanical tasks. For instance, plant identification, key construction and standardised plant descriptions can be performed, and there are programs to describe vegetation and detect ecological gradients using multivariate techniques (Dr Patridge).

ECOLOGICAL STUDIES OF INDIVIDUAL SPECIES AND SPECIES GROUPS

Fundamental to understanding the functioning of communities is understanding of the behaviour of individual species or groups of species. Several studies of this kind have been initiated or continued during the 1982-84 triennium including three, funded by the Noxious Plants Council, that aim to elucidate the biology of weeds of productive land and remnant stands of native vegetation.

NATURALISATION OF PLANTS IN URBAN AUCKLAND

This study is nearing completion. It aims to identify events and human activities that have promoted the introduction, establishment and spread of alien plants. It is the story of how 600 plant species arrived in Auckland, their modes of life, and why some have been more successful than others in establishing in a new land (Mr Esler).

NATURALISED PLANTS IN SOUTHWEST SOUTH ISLAND

A record of the naturalised plants in Fiordland National Park, Waitutu State Forest, and forested land between the Park and Haast to the north has been published. It discusses their origins, ecology and management (Dr Johnson).

Clematis vitalba (funded by Noxious Plants Council)

This introduced vine threatens both native forest and, in some places, introduced willows used for stabilising river banks. A three-year research contract was begun in September 1984 in order to make a field and experimental study of the vine. The aim is to define the magnitude of the threat posed by this species and, if possible, identify aspects of its biology that could be exploited during control and eradication work (Miss West).

SPANISH HEATH (funded by Noxious Plants Council)

Spanish heath *(Erica lusitanica)* is a shrub weed of mainly poor soils in the North and South Islands. A literature review has been compiled and a one-year study to be completed in 1985 is examining aspects of its ecology. This includes the growth and phenology of adult plants, and aspects of seed and seedling ecology, which will give an understanding of this shrub's likely response to competition from pasture, grazing, and other management practices (Miss Mather).

NASSELLLA TUSSOCK (funded by Noxious Plants Council)

Nassella tussock *(Stipa trichotoma)* is a major weed in North Canterbury and Marlborough, and it appears to be spreading in other parts of New Zealand. A literature review has been prepared and an intensive study has begun to investigate several aspects of the life cycle of nassella tussock. Particular emphasis is being placed on the seeds and seedling ecology.

The effects of environmental factors including pasture competition and the effectiveness of control measures presently being used are being monitored (Mr Taylor).

HAWTHORN IN CANTERBURY

Hawthorn *(Crataegus monogyna)* is a European shrub or low tree which is widely distributed in the South Island. Three populations of hawthorn were studied to assess its dynamics and persistence in different plant communities. Hawthorn is predicted to increase in areas of native shrublands and lightly grazed pastures, but it does not persist in native forests where these are free from disturbances such as grazing (Dr Williams, Mr Buxton).

FLOWERING CURRANT IN CANTERBURY

This adventive shrub *(Ribes sanguineum)* was reported to be spreading onto farmland in Canterbury. A field study showed that most flowering currant bushes are more than ten-years-old, and the apparent spread of this plant in recent years has resulted from the suppression of matagouri *(Discaria toumatou)*, a native shrub. Flowering currant is palatable to stock when young and it does not threaten pastoral land (Dr Williams, Mr Buxton).

ECOLOGY OF BRACKEN

Bracken is important on poor farmland that is frequently burnt and in early successional communities throughout New Zealand. Dense bracken inhibits the establishment of woody species, while patchy areas of bracken tend to revert to woody communities more rapidly. These different circumstances are being studied and it appears that one of the main effects of bracken is to protect seedlings from grazing (Dr Partridge).

GORSE IN COASTAL OTAGO

Gorse is a major scrubweed in coastal Otago, causing problems in management of agricultural land and reserves of indigenous vegetation. The

dynamics of gorse stands were investigated on a variety of sites, from sea level to *c.* 350 m altitude, especially with regard to the role of gorse in succession to indigenous forest. Unless indigenous woody plants established at the same time as gorse, they were unable to enter a gorse stand until its first cycle of senescence at 25-30 years of age. Where *Leptospermum* established at the same time as gorse, the latter is displaced in 25 to 30 years. Where establishment of indigenous species is limited by existing gorse stands, replacement of gorse by indigenous woody vegetation should occur within 50 or 60 years (Dr Lee, Mr Allen, Dr Johnson).

Native Brooms

Many native broom species are on the decline because of land development, fire, animal browsing, and the questionable practice of extensive aerial spraying of riparian vegetation with hormone chemicals to control noxious plants. Surveys are recording present-day distributions of New Zealand brooms, particularly species at risk. The range of Canterbury broom *(Notospartium torulosum)* is now very discontinuous, but the species is less rare than was believed. It is absent from the type locality at Mason River, north Canterbury, but seed has been collected from the vicinity and plants will be cultivated at Lincoln for further study.

Many accessible populations of Marlborough pink brooms *(Chordospartium stevensonii* and *N. glabrescens)* have declined or been destroyed, whereas those of more remote situations are thriving. Studies indicate that of the two species described, one — *N. glabrescens,* may be a limestone ecotype of a single widespread species in Marlborough.

The recent discovery of a new species of chord broom *(Chordospartium muritai)* growing in coarse outwash gravels on the coast at Clifford Bay, Marlborough, is of considerable botanical and ecological significance. As only one population of this broom is known, it is one of New Zealand's rarest plants. The site occupied by *C. muritai* has been established as a scientific reserve with restricted access, and efforts are being made to increase the number of brooms growing there.

Surveys have shown that *Chordospartium stevensonii* is still highly endangered and of very local distribution, but the future of the species seems assured as good populations have been found in montane areas of the Seaward Kaikoura Range. We now know *C. stevensonii* grows in a range of free-draining alluvial and montane soils. A population at lower altitude in a tributary of the Awatere River has been reserved.

The endangered lianoid broom, *Carmichaelia kirkii,* is now rare in North Otago, including the type locality, and reduced to one population in North Canterbury. The recent discovery of a plant of *C. kirkii* in the valley of the Tone River — a tributary of the Awatere River, in Marlborough, considerably extends the former known range of the species. The main populations of this broom are now confined to South Canterbury and the Mackenzie Basin with a few isolated populations occurring in Otago. There is an urgent need for reserves to protect this endangered broom species (Mr Purdie).

Silver Beech in the Catlins

The reproduction, dispersal, competitive ability, distribution and population dynamics of silver beech within pure beech forest and adjacent to other vegetation types have been studied. Silver beech is invading and displacing red tussock grassland, *Leptospermum* and other types of scrub,

Dacrydium biforme bog forest, and forest dominated by *Weinmannia* and *Metrosideros* on all but the wettest or most fertile sites studied. Beech spreads by marginal displacement of other vegetation types and by establishment of nuclei of invasion up to six km from the beech seed source. In most respects the behaviour of silver beech in the Catlins, its southernmost distribution, is similar to that described from western Southland, south Westland and north Westland, the main areas of silver beech in the South Island (Mr Allen).

ECOLOGICAL STUDIES OF ENVIRONMENTAL PROCESSES

Study of the processes affecting natural environments are essential for knowing what kinds of changes are occurring and understanding reasons for such changes. Without this information we have no scientific basis for managing ecosystems, or protecting either parts of the landscape or particular plant or animal species that are worthy of protection. Processes usually affect all parts of the system studied in some way so that classifying these studies is somewhat artificial. It has been convenient here to list the studies under trends and mechanisms of succession, climate-plant relationships, soil-plant relationships, animal-plant relationships, and island processes.

TRENDS AND MECHANISMS OF SUCCESSION

Succession in Gumland Scrub Communities

The distribution, floristics, spatial patterns and structure of gumland scrub communities is being examined in order to elucidate the major pathways of succession and ultimately identify the primary causes of the changes occurring. The work includes study of woody adventives with a view to their management and control (Dr Clunie).

Primary Succession on Mount Tarawera

This study, now completed, was made on the high domes of Mt Tarawera. With increasing distance from the 1886 eruption craters, vegetation complexity and rates of succession increase (Dr Clarkson).

Secondary Vegetation on the Port Hills, Canterbury

This study found that patches of broom *(Cytisus scoparius)* were colonised by elder *(Sambucus nigra)* in about 10-12 years, but this in turn was invaded by the native mahoe *(Melicytus ramiflorus)*. Broom and elder are therefore considered desirable species where the aim of vegetation management is to re-establish native forest in this region (Dr Williams).

Scrub Communities in the Kawarau Gorge

Investigations into the hydro-electric generation potential of the Kawarau River, Otago, led to a request from the Ministry of Works and Development for information on the area's vegetation. This prompted a wider study of the many arid climate scrub communities, both indigenous and adventive, which occur within the gorge. The distribution and population dynamics of plant species, and their ecological relationships within various communities, have been recorded with respect to site characteristics such as soil fertility,

aspect, slope, altitude and the effects of grazing. Results of the study should be published in 1985 (Dr Johnson, Mr Allen, Dr Lee).

Response of Woody Seedlings to Light

Light is an important factor in early successional communities where species are jostling for a place in a very dynamic vegetation. The responses of many native and adventive woody seedlings to full light and partial shade were measured in a glasshouse experiment. The results will be analysed to show the growth of shoots with time, the ratios of leaf:stem:roots, and the differences in these parameters in the light versus the shade (Dr Williams, Mr Buxton).

Vegetation Change Models

Mathematical models can be used to describe and predict vegetation change. Tree by tree replacement series have been used to describe vegetation change following disturbance in a river bed in the Coromandel. Initial manuka and kanuka phases are quickly replaced by hardwoods and tanekaha, and eventually by greater amounts of other conifers. Kauri only increases very slowly with time. Such models, however do not describe processes, and therefore models which incorporate population dynamics are being developed (Dr Partridge).

Soil Seed Banks

Seeds buried in the soil play an important part in succession following disturbance such as windthrow. A range of secondary plant communities in Canterbury has been sampled. Bracken stands in this district hold only introduced herbaceous species and therefore have no intrinsic potential to regenerate to woody vegetation. Soils beneath regenerating forest can contain abundant seeds of the introduced gorse and broom, but very few seeds of native species. The latter appear to be short-lived and so they do not accumulate in the soil. To foster vegetation succession in these situations it may be appropriate to over-sow with seeds of native species (Dr Partridge).

CLIMATE-PLANT RELATIONSHIPS

Leaf Temperature of Subalpine and Subantarctic Plants

A Pacific data logger was adapted at Physics and Engineering Laboratory to compare ambient temperature, light, humidity and wind speed with leaf temperatures, measured by thermocouples attached to leaf surfaces. Results support the hypothesis proposed by P. Wardle in 1965, that the structure of many high altitude plants enables them to maximise solar energy in a heat-deficient environment. For example, the cushion plant *Centrolepis ciliata,* the large rosette leaves of the subantarctic herb *Pleurophyllum speciosum,* and the leathery leaves of the subalpine shrub *Olearia colensoi,* which are tomentose beneath, all exceed air temperature by more than 10°C in bright sunshine, and even in cloudy weather show appreciable heat gains (Dr Wardle).

SOIL-PLANT RELATIONSHIPS

Vegetation/soil Development in Otago

Vegetation composition, soil morphology and chemical properties were studied on three sand dunes at Tautuku Bay. Ages of dunes were determined from the largest trees on each as 130, 440, and 1000 years, with increasing

distance from the sea. The vegetation changes from marram grass and a few herbaceous species, through rata-broadleaved low forest, to tall forest of kamahi, rata and podocarps. Soil organic matter increases and pH declines, with consequent increases in secondary compounds of iron and aluminium and higher levels of exchangeable bases. Soil profiles show an increasing number of horizons and textures become increasingly loamy (Mr Allen, Mr S.M. Smith, Mr B.K. Daly, Soil Bureau).

ANIMAL-PLANT RELATIONSHIPS

Effects of Possums on Lowland and Coastal Vegetation (Kapiti Island)

Monitoring of the vegetation of Kapiti Island has continued during the recovery that has followed the re-introduction of possum control in 1980. The control programme has been intensified since 1983 with eradication as the ultimate objective. As the recovery continues, a more comprehensive understanding of the total effect that possums have had on the Island's vegetation, since they were introduced in the 1890's, is becoming possible (Dr Atkinson).

Effects of Goats and Pigs on Coastal Vegetation

Arapawa Island has some of the most interesting and important coastal vegetation remaining in the whole Marlborough Sounds district, but it was badly infested with goats and pigs. Trial plots to exclude animals were fenced in 1978, and regular visits have been made to assess changes. Native forest has regenerated rapidly inside the plots, but has continued to decline outside, even though attempts have been made to control animals. The Marlborough Sounds Maritime Park Board have, therefore, fenced the most important part of this valuable reserve (Mr Walls, Dr G.N. Park, BRC).

Plant Phenological Events and Bird Behaviour

This study compares seasonal events and bird use in tall podocarp-beech forests on valley floors and the adjacent hillslope beech forests. Two sites in NW Marlborough and inland Nelson were chosen for their relative intactness and accessibility. Nearly three years of monthly observations of flowering, fruiting, leaf growth, litter fall, seed fall, and the numbers and feeding habits of birds have been completed, and much of the data analysis done. The study has shown the importance of the valley floor forests in providing fruit for birds in autumn and winter, and the value of beech honeydew, and leaves, in sustaining birds in later winter-early spring when there is a scarcity of other plant foods and invertebrates (Mr Walls, Dr G.N. Park, BRC).

Foliar Minerals in *Coprosma*

An interest in the reasons for the divaricating form of many *Coprosma* species led to this study to determine if high nutritive value (presumed to be related to attractiveness to herbivores) was linked with divarication, which offers some protection against browsing. Analysis of foliar levels of mineral elements showed that divaricating species had higher foliar concentrations of nitrogen, phosphorus and sodium compared with non-divaricating species. This appears to provide support for the hypothesis that divarication evolved as a defence against browsing by large herbivorous birds, especially moas (Dr Lee, Dr Johnson).

ISLAND PROCESSES

Rat Spread

A review and analysis has been made of the factors that have influenced the spread of commensal species of rats *(Rattus exulans, R. rattus, R. norvegicus)* to oceanic islands throughout the world during the last 3000 years. This has resulted in hypotheses explaining the differing effect of rats on island faunas and floras as well as focussing attention on the need to improve precautions against the spread of rats to further islands (Dr Atkinson).

Predation on Seabirds by Introduced Animals

The predatory impact of introduced vertebrates on the world's seabirds has been reviewed and particular case histories discussed. The severity of this predation may be influenced by physical features of the habitat, availability of alternative foods for the predator, and size and behaviour of predator and prey species. Extermination of cats and increased preventative measures against further introductions of all alien predators are the most important priorities in preventing further depletion of seabird populations by such predators (Dr P.J. Moors, Wildlife Service, Dr Atkinson).

Poor Knights Islands

Following a vegetation mapping in 1980 of Tawhiti Rahi, the northernmost island in the group, a second visit in 1984 has allowed the mapping of the southern islands in the group. A full account of this work is in preparation (Dr Atkinson).

Noises Islands, Hauraki Gulf

This study, initated in 1978, is continuing and is designed to elucidate the role of local climatic factors and soil conditions in determining trends and rates of succession (Dr Atkinson).

Botany of Southern New Zealand Islands

A record of botanical information from trips to the Solander and Muttonbird Islands, west and south-west of Stewart Island, has been published. It includes a list of all the plants and aspects of the ecology of the tree daisies *(Olearia)* (Dr Johnson).

SEEDS

(Mrs M.J.A. Bulfin)

Seed Germination

Investigations have continued into the requirements for germination of a wide range of seeds of New Zealand species. Seeds are tested soon after collection and then at three monthly intervals until stocks are depleted or until viability is nil. This has shown that many species have a seasonal preference for germination and will only germinate, or will have a higher percentage of germination, at certain times of the year. A period of stratification is necessary for seeds of many species, including those from some lowland habitats. Some species have highly developed survival mechanisms to ensure that seeds will only germinate when conditions are

suitable. For example, seeds of *Oreostylidium subulatum* (Stylidaceae), a species of boggy areas, were kept on moist germination substrate for nearly five years but only germinated when the substrate was dried.

Seed Atlas

During the latter part of this period attention has been concentrated on seeds of dicotyledons and to date over nine hundred of these have been photographed for the Atlas either by light microscope or on the scanning electron microscope. Some eight hundred and fifty stubs have been prepared and examined on the S.E.M. and these will be retained for further use if necessary. Seeds of Cyperaceae, Juncaceae and many smaller families of monocotyledons have also been photographed.

Seed Identification

The demand for seed identification is a continuing one with requests coming from diverse sources. They include:

(1) Other government departments (Ecology Division, Grasslands Division, Chemistry Division, DSIR and Wildlife Service, Internal Affairs).
(2) Universities (Zoology, Anthropology Departments).
(3) N.Z. Historic Places Trust (archaeology).
(4) M.A.F. (crop impurities and from veterinarians).
(5) M.O.W.D. (weedy species).
(6) Temuka Milling Co. and other private farms (impurities).
(7) Research Institute for Textile Service.
(8) Private individuals and some institutions.

The number of species per sample to be identified ranged from one to sixty-eight.

Seed Requests

There is continued interest, particularly from overseas correspondents, but also from within New Zealand, for seeds of New Zealand plants. We have sent seeds of a representative range of species to botanic gardens in Great Britain, many European countries, Canada, U.S.A., South Africa, Australia and other regions. Requests continue to come from pharmaceutical companies needing to investigate possible therapeutic properties in some of our plants and from scientists involved in genetical research and other areas of research. Personnel establishing seed banks for long-term storage of seeds have expressed interest in obtaining seeds of rarer species or of species which may be of use in future plant breeding.

Seed Herbarium

Approximately 800 packets of seed have been added to the Seed Herbarium.

BIBLIOGRAPHY, BIOGRAPHY AND SCIENCE HISTORY

(Dr A.D. Thomson)

Leonard Cockayne

As necessary preliminary research to the completion of a full biography on the life and work of Leonard Cockayne, New Zealand's foremost botanist, the bibliography of his published work was published in 1982 (*N.Z. Journal of Botany 20*: 205-219). Still to be published is a compilation of the content of Cockayne's field notebooks and his unpublished manuscript material. Earlier, parts 1 and 2 of the series on the annotated summaries of the Cockayne letters were published (Ibid. *17*: 389-416; *18*: 405-432) and further parts of the series including the important Cockayne: Cheeseman and Cockayne: Gibbs letters are in preparation. In addition, over the years a number of other items relating to Cockayne have been published (e.g. "The original publication of Leonard Cockayne's 'New Zealand Plants and Their Story'", Ibid. *13*: 807-809; "Leonard Cockayne: horticulturist", Ibid. *16*: 397-404) and much new data relating to Cockayne's life and work has been recorded in the *Botany Division Newsletter*; an index to this data is available at Botany Division.

This information is of botanical significance, adds to our knowledge of New Zealand botanists, and provides some understanding of the history of plant science in the period from the 1890s to 1934.

As a "pipe opener" to the full biography of Cockayne, a paper entitled "The Life and Correspondence of Leonard Cockayne", which was presented at the first History of Science in New Zealand Conference in Wellington in 1983, was published as a booklet with the same title. It gives a brief survey of Cockayne's life and work and is especially concerned with his early formative years.

Cockayne Library and Photograph Collection

As an adjunct to the above studies, a library of the published works of Cockayne has been established by purchase, gift and by copying from sources in New Zealand and overseas. This library of Cockayne's publications is probably the most complete in existence. Associated with the library is a collection of photographs relating to Cockayne and his work and includes a portrait collection. An endeavour is being made to establish an inventory of extant plates of the photographs published by Cockayne. The library and photograph collection are available to New Zealand botanists and provide some of the basic material for research associated with the proposed Cockayne biography.

Biography of Botanists

From time to time biographical items about botanists are published and recorded in *Botany Division Newsletter*. The Index Botanicorum Novae Zelandiae (below) is one source of information. A publication in this section of the work was a booklet to commemorate the retirement of Dr E.J. Godley in 1984: "Eric Godley Botanist: A Pictorial Record of His Career" (published

by Botany Division, 1984, 29 pp.). This booklet is almost entirely a pictorial record of Dr Godley's career from student days to Director of Botany Division and is meant to relate facets of his long and distinguished career. Copies of the booklet were provided for participants in the Symposium on Research on the Vegetation of New Zealand, held at Lincoln on 1 and 2 May 1984, and were also distributed to libraries, institutions and individuals in New Zealand and overseas.

Index Botanicorum Novae Zelandiae

The aim of this project is to assemble data and photographs relating to New Zealand botanists from all available sources. Overseas botanists who have an association with New Zealand are also included. It is hoped that the Index will eventually include the complete publication records of most contemporary New Zealand botanists. The term botanist is interpreted in the widest sense and includes amateur as well as professional botanists. The immediate basis of the Index was a collection of biographical items and newspaper clippings relating to New Zealand botany and botanists which have been assembled over some 15 years. Material donated by senior Botany Division staff at the time of their retirement has also been added. Greatly supplementing these items was a large collection of old newspaper clippings, etc. left by Dr Lucy Moore at the time of her retirement, and including the H.H. Allan botany scrapbooks (see *BD Newsletter No. 47*: 12-13; Ibid. *No. 72*: 6-7). To bring some order to this potentially valuable resource it was decided to establish the Index as a repository for items relating to botanists and our botanical heritage.

The object of the Index is to complement the resources of the Library and Herbarium at Botany Division. It is based to some extent on a proposal put forward by the late Franz Verdoorn for a world index (*Chronica Botanica 3*: 427-448) though the New Zealand Index will contain a component of archival material. This is a continuing long-term project and it is hoped that botanists of all persuasion will donate archival material which otherwise would be lost. It is anticipated that it may be a number of years before the resources of the Index are substantial.

Chronology of Discovery in New Zealand Science

As part of a long-term interest in the origin and development of New Zealand science, a chronology of discovery in New Zealand science is being assembled for a book entitled "The New Zealand Book of Events". The chronology will be one of some 49 chapters on all aspects of New Zealand life and is scheduled for publication in early 1986. Much of the chronology has been assembled from Dr Thomson's card index on the history of New Zealand science. There is a firm bias to biology (including medical research and some aspects of agriculture) and this reflects the major emphasis of our science since the beginning of pakeha settlement. However in the first entry (1769), an attempt has been made to emphasize that the knowledge of the early Maori people, certainly in aspects of biology, was substantial though not of course formalised into what we call science today; the persistence and precision of Maori names for plants is an indication of this knowledge.

Achievements of Agricultural Science in New Zealand

A chapter relating to botany and plant science is being prepared for a

proposed book which records the achievements of agricultural science and is being sponsored by the N.Z. Institute of Agricultural Science. The central theme of the botany and plant science chapter will be Leonard Cockayne and other pioneer botanists. The book is tentatively scheduled for publication in late 1986. Preparation of the chapter is assisted by the Index Botanicorum Novae Zelandiae and the chronology of discovery in New Zealand Science (above) and biographical data relating to Cockayne. Botany is interpreted in the widest sense as the study of plants. Facets of botany such as plant pathology will be covered in other chapters. The starting point is taken as Daniel Solander's "Primitae Florae Novae Zelandiae". Beyond this, however, it will be emphasised that knowledge of New Zealand plants by the Maori people was considerable. Basic and applied research are both integral parts of the New Zealand science scene. Many developments in applied botany had their origin in basic research, e.g. plant tissue culture which now has wide application in agriculture and horticulture. Some major areas of progress in New Zealand have been in the following fields: taxonomy and nomenclature and their application to plant identification; plant ecology as it defines the effect of environmental factors in plant growth; plant chemistry and biochemistry, especially in relation to chemical constituents of plants and food quality for man and animals; plant physiology as it aims to define parameters for plant growth and yield, and optimal conditions for storage; plant genetics, cytology and plant breeding which represents perhaps the most direct and important application of botany. All in all, botany has been a highly successful branch of applied science in New Zealand. Currently there has been an awareness of the significance of our indigenous plants as an aesthetic and productive feature of the environment. Perhaps in the long-term this could be one of botany's major contributions to agriculture in New Zealand.

PLANT PATHOLOGY

(Dr A.D. Thomson)

Virus Diseases of Indigenous Species

The occurrence of six viruses, probably all originating from infected introduced hosts, has so far been recorded as affecting five indigenous species (*N.Z. Journal of Agricultural Research 24*: 401-402; *Journal of the Royal Society of N.Z. 13*: 199-200). The failure to establish at Lincoln cuttings from diseased *Senecio bennettii* plants growing in Governor's Bush, Mount Cook National Park, has so far prevented the characterisation of the suspected virus of this subalpine species. Another suspected virus disease has also been observed causing a bright yellow mosaic and stunting disease of *Pachystegia insignis* growing in plots at Lincoln.

Incidence of Virus Diseases in "Maori" Potatoes

The "Maori" potato is one of our earliest introduced plants and there is documented evidence that James Cook in 1769 gave potato tubers to the Maori people (see *BD Newsletter No. 85*: 11-12; Ibid. *No. 99*: 26-27). The

"Maori" cultivars have characters quite unlike present-day cultivars. Their survival suggests that they may have some resistance to common potato pathogens. A distinctive mottle on plants of the cultivar 'Urenika' growing in Christchurch prompted tests for the identity of the disease. Potato virus Y but not potato virus X was detected in the plants. This is somewhat surprising considering the ubiquitous nature of potato virus X in modern potato cultivars.

E.J. GODLEY

Dr Eric Godley joined Botany Division as its fourth Director on January 1, 1958. He relinquished the directorate on March 31, 1980, and retired as Senior Scientist on May 10, 1984. Eric was educated at Takapuna Grammar School and Auckland University College. He completed a B.Sc. in 1940 and was Senior Scholar in Botany and the following year, 1941, took his M.Sc. and was the Duffus Lubecki Scholar, an award not taken up because of the war.

His botanical career, interrupted by service with the 2nd NZEF (1942-1945), was continued at the University of Cambridge (1945-1947) where he graduated with a Ph.D. in cytology and genetics. When he returned to New Zealand in 1948 Eric was appointed lecturer in genetics in the Department of Botany, Auckland University College, a position which he held until 1951 when he joined DSIR as Senior Geneticist, Crop Research Division, under Dr Otto Frankel. In that same year Eric became Acting Director and was confirmed as Director in 1954. Eric held this position until he transferred to Botany Division as Director in 1958.

As Director, Eric's first and most important task was to house the Division properly. Construction of a permanent base at Lincoln began in May, 1958, and two years later the building was occupied. Since then continued growth has resulted in a major extension to the Library (1971), extension of the laboratory block to include an anatomy and ecology laboratory, and a seed laboratory (1973), and more recently the first part of planned extensions to the Herbarium was completed (1981).

A permanent base at Lincoln was only one of a much larger number of buildings required for Botany Division. Eric was aware of the potential demand for our services throughout New Zealand, and to meet this he set about establishing the network now known as our Regional Stations. The first, at Taita, was established in 1958, and subsequently others were set up in Auckland (1969), Dunedin (1973), and Nelson (1975) during Eric's directorate; since 1981 offices have been opened in Rotorua, Kaikohe, and most recently in Havelock North. Convenient accommodation for regional staff was also a priority, but was not easy to achieve. Satisfactory buildings did not become available at Taita until 1980, and at Dunedin a DSIR building is only now nearing completion.

Staff and accommodation were an early requirement for the efficient management of the nation's botanical interests. To further these interests it was equally necessary to develop modern facilities — to develop the Gardens, the Herbarium, and the Library, and to provide proper instrumentation. Our Experimental Gardens at Lincoln, with their plots, glasshouses, shade-

houses, potting shed and workshop reflect Eric's belief that plants must be studied in the field and under controlled conditions as well as in the laboratory or Herbarium. Development of the East Block was begun in the context of this belief and with the intention of establishing an arboretum or formal garden. To this end the area was fenced, shelter belts were planted, it was irrigated, roaded, and the banks of the former watercourse were contoured and sown in lawn grass. Budgetary considerations have delayed plans for this area, but the ground-work is prepared for whatever form the garden will take in the future.

Just as living plants are essential to the study of botany, so the proper collection and handling of plants from the field and garden is equally necessary. To this end Eric not only provided the best possible accommodation for our Herbarium, but he actively encouraged the maintenance and curation of a growing collection of specimens of native, adventive, and cultivated plants. He also engaged staff to maintain the growing collection.

The role of the Herbarium in the preservation of our national botanical heritage was important to Eric, who was concerned that important collections, private or otherwise, should not be lost through lack of proper curation. Throughout his period as Director gifts of specimens were regularly received or acquired, and amongst the most valuable of these is the herbarium of the Canterbury Museum, including Beckett's moss herbarium, and the private herbaria of Mr K.W. Allison (bryophytes) and Mr William Martin (lichens and mosses).

As staff numbers increased and especially as Regional Stations were established, accessions increased rapidly from about 120 000 specimens in 1958 to the 400 000 specimens housed in the Herbarium today. Eric's own contributions in this respect have been important ones, especially his collections from South America and the Subantarctic Islands of New Zealand.

The Library was the third facility needed for the proper functioning of the Division. The foundations of our present Library were laid when Dr H.H. Allan's private botanical library was purchased in 1949. The library developed slowly until it was housed at Lincoln, and since then holdings of books, journals and reprints have increased rapidly. Eric's concern for the proper development of a botanical library saw practical expression when the Division received a grant of 24 000 pounds from the Scientific Research Distribution Committee of the "Golden Kiwi" lottery. The grant allowed the purchase of back numbers of botanical journals not well represented in New Zealand and this, combined with a continued vigorous purchasing policy, has made the Library at Lincoln one of the leading botanical libraries in Australasia.

During Eric's period as Director the Division's instruments and equipment was upgraded. Perhaps the most important event in this respect occurred in 1969 when the transmission electron microscope unit was transferred to Botany Division from the Plant Diseases Division Substation for easier administration. Its use as a regional facility was encouraged and plans were prepared to improve the associated laboratories, and to make room for a scanning electron microscope in the future. It is now a busy unit in which basic research and routine observations are actively pursued.

As Director, Eric was very much concerned with communication, both within and outside the Division. On the domestic scene he instituted regular

staff meetings as a means of keeping staff informed and to encourage vigorous discussion of matters affecting us all. These meetings continue still, although their format has changed, a tribute to the value of such an exercise in staff relations. As a further means of informing a growing and scattered staff, the first Botany Division biennial conference was held in 1971. Seven such meetings have now been held and they have proved valuable as a means of bringing headquarters and regional staff together for discussion of common problems and to learn of each others work.

The Botany Division Triennial Report, first produced for the years 1957-1959, has provided an account and assessment of our work and further reflect Eric's concern for communication in science. The most outstanding event in this respect was the establishment of the *New Zealand Journal of Botany*, the first issue of which appeared in March 1963. Despite some official concern that the botanical community could not sustain its own journal, Eric's persistence won support and through his efforts as chairman of the editorial board the journal is now well established and enjoys an international reputation.

Throughout his years with Botany Division, Eric has written many papers, and edited several books, including the fourth edition of Cockayne's "New Zealand Plants and Their Story". Perhaps his most widely read papers are those which appeared in the "Botanists Notebook" series which he contributed to the *New Zealand Gardener* from September/October 1978 until his retirement in May 1984. This series, begun to provide "background knowledge which could make your plants and your 'out-door living' more interesting", continues today with contributions from Botany Division staff.

Eric's research interests are broad and encompass the fields of cytology, genetics and breeding systems of plants as well as the ecology and biogeography of plants in the Subantarctic Islands and in southern South America. His work in these fields has earned a respect which extends beyond local shores and is reflected in the honours and awards received during his career with Botany Division. These include Fellow of the Royal Society of New Zealand (1965), Corresponding Member of the Academy of Natural Sciences, Chile (1966), Fellow of the Linnean Society of London (1967), Fellow *honoris causa* Linnean Society of London (1977), and Queen's Jubilee Medal (1977). Since his retirement Eric was further honoured by the award of the Loder Cup (1985).

As Director, Eric's administrative responsibilities extended beyond the Division itself. His contribution to the conservation movement is best exemplified by his work on the Scientific Co-ordinating Committee for Beech Research. Much of the success in this area lies in Eric's firmly held belief that unhindered by statutory requirements, he could apply an objective approach to each problem as it arose. Another responsibility which extended beyond the Division was involvement with the Miss E.L. Hellaby Indigenous Grasslands Research Trust, founded in 1959, and of which he was Governor of the Board from 1960-1984. In this capacity his influence on New Zealand botany has been as important as any other.

When Eric retired in May 1984 the botanical community honoured him at a symposium which took stock of the state of botany in New Zealand, and considered the directions it might take in the future. There could have been few at that symposium whose careers had not been influenced in one

way or another by Eric, and it may well be that his greatest contribution to botany in New Zealand has been his willingness to help people inside and outside the Division reach their potential in the service of New Zealand botany. This concern for people is reflected in the friendly and considerate attention he gives to anyone who approaches him for help or advice (Dr N.T. Moar).

H.E. CONNOR

When Dr Henry Connor, fifth Director of Botany Division, retired on 4 August, 1982, he had worked at Botany Division for 40 years and served in every capacity from technical trainee through scientist, Officer-in-Charge of the Christchurch Substation, Assistant Director and head of Taxonomy Section, to Director.

Henry Connor was educated at St Patricks College, Wellington, and on leaving school he joined the Plant Research Bureau in 1940 as a clerical cadet. From there he was selected by Dr H.H. Allan as a technical trainee for Botany Division, to which he was appointed in 1942. Dr Allan encouraged him to take a science degree at Victoria University College and from 1942 to 1945 Henry combined work for Botany Division with service in the Home Forces and study at the University. He gained the M.Sc. degree in botany in 1950 with a thesis on *Agropyron*.

Under the guidance of Dr Allan, he had very early chosen his life-time field of research — the indigenous grasses of New Zealand. A study of their reproductive systems soon expanded into experimental taxonomy and studies of hybridisation, and then from studies of the growth and development of tussock grasses to the ecology of the grasslands which they dominate, and latterly to chemotaxonomy and formal taxonomy, the synthesis of all his previous work. In 1978 he was awarded the degree of D.Sc. by the University of Canterbury for his publications on the botany of tussock grasses and grasslands, and in 1983 elected a Fellow of the Royal Society of New Zealand. At the time of his retirement he had published 90 scientific papers and had ensured that all of his technical assistants had published at least one paper jointly with him.

His first paper on the breeding systems of New Zealand grasses, a study on *Dichelachne* with Audrey Cook, appeared in 1952 and was the start of a long series of papers, continuing in retirement, in which the breeding system of almost every indigenous grass genus has been investigated. Continuing from his M.Sc. thesis, and inspired by Huxley's "New Systematics" published in 1940, to which H.H. Allan was a contributor, Henry was the first in New Zealand to apply the methods of experimental taxonomy. Large numbers of accessions of the native wheat grasses were raised together at the Division's experimental gardens at Waiwhetu, Hutt Valley, and he demonstrated that *Agropyron scabrum* (now *Elymus rectisetus*) in particular had evolved a series of geographical races differing morphologically and in their reproductive systems. His findings were associated with the cytological studies of Dr John Hair. After more than thirty years work the reproductive systems of New Zealand grasses are now better known than those of most countries and Dr Connor is a world authority

on the subject. His survey of the breeding systems of grasses of the world, presented at the International Symposium on Reproduction in Flowering Plants, organised by the Royal Society of New Zealand and held in Christchurch in February 1979, is a classic review of the subject. In October of that same year he was invited to an international symposium on grasses at St Louis, Missouri, to speak on the evolution of reproductive systems in the Gramineae.

Another major interest was poisonous plants. Between the end of the Depression and the early years of World War II, Dr Allan was recruiting botanists to assist with projects on economic botany and when Henry Connor joined Botany Division he became responsible for work on poisonous plants. He published his first scientific paper in 1945 on that topic. This was followed by a series of papers in the *New Zealand Journal of Agriculture* and in 1951 by the publication of "The Poisonous Plants in New Zealand" (DSIR Bulletin No. 99). Throughout his service with Botany Division he maintained his interest in poisonous plants on which he is the New Zealand authority. The second revised edition of the Bulletin published in 1977 was greatly expanded to include the findings of recent developments in the chemistry of toxins and of toxicology and the extensive reference list (over 700 titles) indicates the scope of his bibliographic research into all aspects of poisonous plants. In 1981 he was invited to give the Banks Lecture to the Royal N.Z. Institute of Horticulture on "Poisonous Plants and Horticulture in New Zealand".

By 1950 the Botany Division headquarters at 8 The Terrace, Wellington were becoming too cramped and the decision was made to move to Christchurch. In August 1951 Henry came to Christchurch to supervise the development of the 10 or so acres purchased for the Division at Greers Road until the property was relinquished in 1957 and the plantings of tussock grasses had been moved to Lincoln. During this time tussock grasslands were a major interest of the Division with Dr Lucy Moore continuing Dr Allan's observations on the depleted tussock grasslands of the Molesworth Station and Henry Connor investigating breeding systems and carrying out hybridization experiments with *Chionochloa, Festuca* and *Agropyron*. He was a member of the Tussock Grasslands Research Committee in 1954 which reported on the high altitude snow-tussock grasslands of the South Island. In the 1960s he turned to floristic analysis of the tussock grasslands of Canterbury and North Otago and his review, with Tony MacRae, in the "Natural History of Canterbury", 1968, summarises a large part of this work.

In 1960 Henry Connor, with David Penny, reported the occurrence of gynodioecism for the first time in the grass family, in the genus *Cortaderia* — New Zealand toetoes and South American pampas grasses. He built up large living collections at Lincoln of both New Zealand and South American plants and continues to elucidate the genetic control of male sterility and the probable evolution of the patterns of sexual expression in this genus and its relatives in subfamily Arundinoideae. In five species of *Cortaderia* gynodioecism has been replaced by apomixis and when Dr Melva Philipson confirmed the type of apomixis she discovered the very rare haustorial synergids of *Cortaderia* which are known in only four other genera of angiosperms. In a recent study Melva Philipson and Henry Connor considered

the occurrence of this character within the Arundinoideae and its significance in the evolution of this tribe.

The classification of grasses, particularly at the specific level, is notoriously difficult and Henry always sought new characters, and new methods and techniques to differentiate species. He is probably the first taxonomist to have applied phytochemical techniques in New Zealand. First, in collaboration with Dr Michael Martin-Smith of U.K., he investigated the surface wax components of leaves of species of *Cortaderia* and by this means recognised the new species *C. splendens*. Then, with Andrew Purdie, he made a comprehensive survey of the leaf-wax chemistry of species of *Chionochloa*. His formal taxonomic revisions, of *Rytidosperma* and *Dichelachne* with Dr Elizabeth Edgar and of *Elymus* with Dr Askell Löve, his current work on *Chionochloa* and *Stipa*, and his observations of the breeding system of *Cortaderia* and many other native New Zealand grasses, are basic to the production of the volume of Flora of New Zealand dealing with grasses, of which he will be joint author with Elizabeth Edgar.

Henry's enthusiasm for research on grasses was equally matched by his unselfish and enthusiastic service as DSIR representative on committees where his scientific expertise was of great use. He served on the North Canterbury Nassella Tussock Board from 1952 to 1976 and on the North Canterbury Catchment Board from 1956 to 1980 where for more than a decade he was Chairman of the Water Committee. He was a member of the Mount Cook National Park Board from 1959 to 1981 and edited several editions of the handbook to that park. In his retirement he is a Visiting Fellow of the Centre for Resource Management, University of Canterbury, and staff and students of that institute now benefit from his long experience on public committees. He is also a member of the Research and Surveys Committee of the National Water and Soil Organisation and of the Protection Forest Research Advisory Committee.

At the end of March 1980 Dr Eric Godley relinquished the Directorate to return to full-time botanical research and Dr Henry Connor was appointed Director of Botany Division. Throughout his career Henry has valued the contacts he has made with botanists overseas, from his very first visit to Australia in 1951 when he attended ANZAAS at Brisbane, then in 1958 to South and North America studying nassella tussock and other grasses, again in 1975 to South America, and in 1979 to North America, as well as to many herbaria in Europe in those two years. Whenever he was on leave in Australia and while on long service leave in Europe he made a point of visiting herbaria there. He attended two International Grasslands Congresses and two International Botanical Congresses, Leningrad (1975) and Sydney (1981). As Director he fostered contacts with botanical institutions throughout the world, staff members were encouraged to attend the International Botanical Congress at Sydney, and he was the first New Zealander to attend a meeting of the Council of Heads of Australian Herbaria, CHAH. His proposal for a joint CSIRO-DSIR Symposium on plant taxonomy was acted upon and took place in Canberra, 1983. Although he had by that time retired he made a generous and most valuable contribution to the planning for the meeting and to the deliberations at Canberra. In February 1985 he gave the Nancy Burbidge Memorial Lecture on the "Australian Flora and its Effect on the Taxonomy of the Angiosperms"

at the Australian Systematic Botany Society's Symposium on Alpine Biota held at Thredbo, N.S.W. He also made sure that Botany Division in its turn should welcome visits from overseas and New Zealand scientists and impressed on the staff that they should endeavour to make the Division "a good place to visit".

From Dr H.H. Allan and Dr Lucy Moore, he inherited his zeal to maintain Botany Division's tradition of sound, scholarly research on the plants of New Zealand, expressed in well-written articles and books. He shared their faculty of conceiving large projects and carrying them out relentlessly with meticulous attention to detail. He encouraged, and still encourages, his colleagues to produce work of high quality by helpful discussion and critical assessment of their papers, and he has a genius of his own in frequently suggesting different worthwhile lines of approach. It was entirely fitting that on the eve of his retirement Henry Connor should be the first recipient of the Allan Mere for "long and faithful service to Botany Division" (Dr E. Edgar).

A.P. DRUCE

Mr Tony Druce retired on 14 December 1982 after 31 years service in Botany Division. Tony's main contributions have been as a field botanist. An enthusiastic young botanist once commented that Tony was the person to stay beside on field trips; this surely must be the greatest compliment that can be paid to a field botanist. In a farewell function to honour Tony, held at Botany Division on 29 October 1982, Dr Eric Godley, in selecting an appropriate text for the occasion, chose the well-known advice Leonard Cockayne received from his old Scottish friend Robert Brown ter., "Heed not what books or authority teaches but, in order to really learn, go to the plants themselves". At this farewell function Tony was presented with the coveted Allan Mere for service to Botany Division.

Tony's background of academic training was unusual for a botanist in that he had a bachelor of engineering degree. Another distinguished plant scientist, the late Mr J.O.C. Neill also had an engineering background (mining).

Tony was first appointed to government service at the Auckland Industrial Development Laboratories (now Division) in 1942. From there he went to the Dominion Laboratory (now Chemistry Division) and was appointed to Botany Division in 1947 to work on vegetation surveys. When the Division moved from Wellington to Christchurch Tony remained in Wellington, transferring to the Soil Bureau in 1954 and later in 1958 returned to Botany Division to establish the Wellington Regional Station at Taita. He remained at Taita until his retirement in 1982.

Tony contributed substantially to the work of Botany Division by the application of his botanical expertise; the work of a Regional Station is varied and on occasion demands a jack-of-all-trades approach. Tony has been generous in making his botanical expertise freely available to all. In recognition of this facet of Tony's contribution to New Zealand botany it could be mentioned that one major botanical book has been dedicated to him ("Eagle's Trees and Shrubs of New Zealand", Second Series, 1982). A special feature

of Tony's work was his botanical surveys in many parts of New Zealand, but especially in the Wellington region. The Herbarium reflects the extent and diligence of Tony's field work. He has developed an unrivalled knowledge of plant distribution and a field knowledge of the indigenous flora. In general, botanical surveys were somewhat under-valued in earlier years and when Tony commenced his work surveys had not as yet reached the pivotal importance of today. Tony has paid particular attention to mountain vegetation and has made a lengthy study of Mt Egmont commencing in 1959. A feature of the surveys has been the preparation of substantial, though mostly unpublished, check-lists. Some such as "Trees, shrubs and lianes of New Zealand (including wild hybrids)" (revised 1980) are major compilations. Though not formally published these check-lists have been widely distributed and are readily available to botanists.

Tony has been closely associated with the Wellington Botanical Society and was president in 1962. In his capacity as editor of the *Bulletin of the Wellington Botanical Society* Tony was a pioneer in communicating botanical knowledge. The Bulletin first appeared as a modest cyclostyled pamphlet in June 1941 edited by Lucy Moore and Greta Cone, price 3d. Tony succeeded Lucy as editor in 1949 and continued in this position until 1966, an achievement of some magnitude. During this period the Bulletin became established as a significant publication for New Zealand botany and is one of our most cited botanical journals. Tony also acted on the editorial committee of the N.Z. Ecological Society in the 1960s.

Formal publications are just one measure of a botanists contribution. Tony's published work is of modest proportions and perhaps his major contribution is "Botanical Survey of an Experimental Catchment, Taita, New Zealand" (DSIR Bulletin 124, 1957). His first publication was "A Botanical Trip to the Northern Kaimanawas" in *Tararua 3*: 71-78, which described a field trip with long-time friends and colleagues Norman Elder and Michael Greenwood. I have noted some 63 published items by Tony, mostly in the less formal journals: *Tararua, Bulletin of the Wellington Botanical Society, N.Z. Science Review, Tuatara, Proceedings of the N.Z. Ecological Society, Tane, N.Z. Soil News, Canterbury Botanical Society Journal, Auckland Botanical Society Newsletter, Tussock Grasslands and Mountain Lands Institute Review* and *N.Z. Journal of Botany*. Most publications (some 35 items) are in the *Bulletin of the Wellington Botanical Society*.

As a result of his interest in the taxonomy of *Coprosma* Tony established in cultivation at Taita a unique collection of virtually all *Coprosma* species recognised in the New Zealand region including 50 species, 5 subspecies and 8 undescribed entities (Botany Division Triennial Report 1976-78, p.44).

It is good to record that in retirement Tony maintains a close link with Botany Division and continues an active botanical survey programme (Dr A.D. Thomson).

D.J. GALLOWAY

Dr David Galloway transferred to Botany Division from Applied Biochemistry Division in December 1972 to work on the New Zealand Lichen

Flora. While studying at Otago University towards a Ph.D. degree in biochemistry his interest in lichens was strengthened by his contact with Dr James Murray, and after Murray's tragic death in 1961, David helped Mr Peter James of the British Museum to curate Murray's large herbarium collection.

Dr Galloway's work on New Zealand lichens has been based on a combination of field work in New Zealand and study of collections in many herbaria in the Northern Hemisphere. From 1973 to mid-1977 he was seconded to the British Museum to study historical collections in Europe, and in the years 1977 to 1981 he divided his time between Botany Division and the British Museum at six-monthly intervals.

When David resigned from DSIR in April 1982 the manuscript of the Flora was complete. In November 1982 he was appointed a Senior Research Fellow at the British Museum and continues his study of the taxonomy and biogeography of temperate Southern Hemisphere lichens. "Flora of New Zealand Lichens," published in 1985, is a major flora for the Southern Hemisphere region (Dr E. Edgar).

OVERSEAS VISITS

DR I.A.E. ATKINSON attended the XVIII World Conference of the International Council for Bird Protection in Britain in August 1982, where he presented a paper on the spread of rats to oceanic islands. Following the Conference, several days were spent at Banchory, Merlewood and Bangor Research Stations of the Institute of Terrestrial Ecology where methods of dealing with quantitative data from vegetation surveys were discussed.

MRS M.J.A. BULFIN visited Canada, USA, Britain, Denmark, Norway and Sweden in April and May 1984, to investigate long-term storage of seed with a view to establishing a genebank for the NZ flora. Mrs Bulfin also recorded the success or otherwise of NZ plants grown overseas, and established contact with Greta Berggren, author of two Seed Atlases.

DR U.V. CASSIE-COOPER attended the First International Phycological Congress in Newfoundland, and visited universities and research laboratories in Norway, Sweden and USA, dealing with marine and freshwater algal taxonomy and ecology, in 1982. Dr Cassie-Cooper attended the International Marine Plankton Symposium at Shimizu, Japan, and the 7th International Diatom Symposium at Philadelphia in 1984. Time was also spent investigating New Zealand diatom collections in the Smithsonian Institution, Washington.

DR E. EDGAR attended the DSIR/CSIRO Colloquium on Plant Taxonomy at Canberra in September/October 1983. Time was also spent at the National Herbarium of New South Wales, studying *Trisetum* species.

DR P.J. GARNOCK-JONES was in England and Sweden from September 1981 to November 1982, on a DSIR Study Award. He attended the DSIR/CSIRO Colloquium on Plant Taxonomy at Canberra in September/October 1983, and at the National Herbarium of New South Wales he studied Brassicaceae, *Hebe, Ranunculus, Parahebe* and *Scleranthus*. In May 1984 Dr Garnock-Jones attended the Symposium of Cladistics, Systematics and Phylogeny at Canberra, and visited several herbaria.

DR D.R. GIVEN attended the Workshop on Conservation of Plant Genetic

Resources at New Delhi, India, and visited Australia and Indonesia in 1982. He attended the DSIR/CSIRO Colloquium on Plant Taxonomy at Canberra in 1983, and undertook fieldwork in southern New South Wales, eastern Victoria and southwest Victoria. In December 1984 Dr Given joined a biological expedition to Terra Nova Bay, North Victorialand, Antarctica.

DR W. HARRIS visited herbaria and research institutes in Queensland, New South Wales, Victoria and Tasmania in October and November 1983. He attended the meeting of Council of Heads of Australian Herbaria in Melbourne and collected seed of *Leptospermum* and *Kunzea* species.

DR W.G. LEE has been at the Botany School, Cambridge University, England since April 1984 on a DSIR Study Award, undertaking a comparative study of the ecology of shrub species in different communities on calcareous soils in southern England. He attended the British Ecological Society Winter Meeting in December 1984 in Liverpool and has also carried out field work in West Germany and Switzerland and visited several ecological research institutes.

MISS B.H. MACMILLAN attended the DSIR/CSIRO Colloquium on Plant Taxonomy at Canberra in 1983, and visited the Bureau of Flora and Fauna and the National Botanic Gardens.

DR M.S. MCGLONE attended the ANZAAS Conference in Australia in May 1982, where he presented a paper on the deforestation of New Zealand. Visits were made to Monash University, Melbourne and the Australian National University, Canberra. Dr McGlone spent a month in 1984 at the Climatic Research Unit, University of East Anglia, Norwich, working on a joint project to determine if palaeoclimatic data can be derived directly from New Zealand pollen rain. In July 1984 he attended a meeting of the Climates of the Holocene Mapping Group at Madison, USA. This group aims to reconstruct global climates from 18,000 BP to the present, by means of a general atmospheric circulation computer model.

DR N.T. MOAR attended the VI International Palynological Conference at Calgary, Canada, in August 1984, where he presented a paper on melissopalynology.

DR B.P.J. MOLLOY attended the DSIR/CSIRO Colloquium on Plant Taxonomy at Canberra in 1983. He also visited New South Wales, Victoria, Tasmania and Queensland to study and collect conifers, orchids and *Corynocarpus*; other topics investigated by Dr Molloy during his visit included fire ecology, native plants in horticulture, ecology of *Discaria*, firewood species, and the Franklin Dam proposal.

DR M.J. PARSONS was granted an overseas study award to work with Professor H.B.S. Womersley, University of Adelaide, on the southern Australian and New Zealand species of *Dasya* (Rhodophyta) from January 1982 until January 1983. He attended the third Annual Meeting and Conference of the Australasian Society for Phycology and Aquatic Botany (ASPAB) at Griffith, New South Wales, 9-10 May 1982 and was elected Vice President. He also attended the fourth Annual Meeting and Conference of ASPAB at Melbourne, Victoria, 2-11 December 1983 where he was elected President. At the fifth meeting of this Society held at Rottnest Island, Perth, Western Australia, 3-7 December 1984 he was re-elected President for a further term. In December 1984 — January 1985 he had special leave on pay to continue his work on *Dasya* with Professor Womersley in Adelaide.

MR A.W. PURDIE visited various British botanical institutions and botanic gardens in August and September 1982, to record and inspect the type specimens and historical botanical collections of New Zealand brooms and to inspect specimens of brooms growing in botanic gardens.

MR W.R. SYKES attended the DSIR/CSIRO Colloquium on Plant Taxonomy at Canberra in 1983. While in Canberra he visited the Botanic Gardens and Australian National University. Mr Sykes also joined a field trip to Central New South Wales, visited the Royal Botanic Gardens and herbarium at Sydney, and undertook field-work in the Sydney area.

DR P. WARDLE spent four months overseas in 1982. During this time, a month was spent at the Geography Department, University of Heidelberg, by virtue of a grant from the German Academic Exchange Service. Field-work was carried out in Nepal, Kenya and Alaska, and visits were made to botanical institutions at Cambridge and Innsbruck. The general objectives were to gain background for timberline studies, and for preparing a new "Vegetation of New Zealand".

DR C.J. WEBB visited colleagues and herbaria in USA, England and Singapore in July 1982. In July 1983 Dr Webb attended the IOPB Symposium "Plant Biosystematics : 40 Years Later" and visited colleagues and herbaria in USA and Canada. He also attended the DSIR/CSIRO Colloquium on Plant Taxonomy at Canberra in September 1983.

OVERSEAS VISITORS

DR SURREY W.L. JACOBS from the National Herbarium of New South Wales, Sydney visited the Division in July 1983.

PROFESSOR BERT G. BREHM, Reed College, Oregon, USA, based himself at Botany Division from September 1983 to January 1984 and furthered his interests in Umbelliferae by working on the biochemistry of hybrids in *Anisotome* and *Aciphylla*, and studying the pollination of *Anistome aromatica*. During January and February 1984 PROFESSOR RUDOLPH M. SCHUSTER (University of Massachusetts: Amherst) visited the Division in order to discuss the preparation of an Hepatic Flora of New Zealand. During this period Professor Schuster accompanied Dr Allan Fife on field trips to Arthur's Pass National Park and to the Paparoa Mountains.

PROFESSOR ARNE STRID, Professor of Systematic Botany at the University of Copenhagen, visited Botany Division from 24 January 1983 to 6 March 1983. Professor Strid's main interest is the flora of the Balkans, especially the Greek Mountain Flora. While in New Zealand Professor Strid visited many alpine regions, paying particular attention to the Ranunculaceae and Cyperaceae.

DR ALLAN J. FIFE commenced work at Botany Division in September 1982, with support from the National Research Advisory Council to September 1985. During this period the New Zealand species of *Entosthodon* (Musci: Funariaceae) have been revised. A study of mosses of the Paparoa Mountains and adjacent coastal region has been completed and is currently being readied for publication. An account of the world distribution of *Distichophyllum transsei*, a species newly discovered in New Zealand, has been published, as have descriptions of new species in the genera *Racomitrium* and *Pohlia*. At least two species requiring taxonomic description have been

discovered. Papers which have been submitted or published include discussions on distributions of rare New Zealand mosses, the phytogeographic affinities of New Zealand alpine mosses, and the history of taxonomic research on New Zealand mosses and hepatics. An annual series of bryological field workshops was initiated in September 1983.

AWARDS

DR D.R. GIVEN: Commonwealth Foundation Travelling Fellowship, 1982.

DR E.J. GODLEY: Loder Cup, 1984.

COMMITTEES AND APPOINTMENTS

MR R.B. ALLEN: Otago Catchment Board.

DR I.A.E. ATKINSON: Fauna Protection Advisory Council; Interdepartmental Steering Committee for *Clematis vitalba* Research; Interdepartmental Working Party for Kapiti Island Possum Control; NZ Ecological Society, Vice-President; Royal Society Standing Committee on Protected Natural Areas; Wellington Land Settlement Committee; Wellington National Parks and Reserves Board.

DR U.V. CASSIE-COOPER: Organising Committee, First International Phycological Congress, Newfoundland.

DR P.J. GARNOCK-JONES: Canterbury Botanical Society Committee; Kowhai River Reserves Scientific Advisory Committee; Systematics Association of New Zealand, Vice-President.

DR D.R. GIVEN: Honorary Advisor, ICUN Monitoring Unit, UK; International Association of Pteridologists; Co-convenor of Conservation of Pteridophytes Programme; ICUN Species Survival Commission; Chairman of Pteriodophyte Specialist Group; Island Plants Group; ICUN Threatened Plants Committee; Royal Society of New Zealand *ad hoc* Committees on National Collections and on Conservation of Plant Genetic Resources; Systematics Association of New Zealand, Councillor.

DR W. HARRIS: Honorary Lecturer, Lincoln College; Committee of Management, Tussock Grasslands and Mountainlands Institute; Advisory Committee, Biological Resoures Centre, DSIR; Ecology Division, DSIR Consultative Committee; Protected Natural Areas Management Committee; National Management Committee, DSIR Computer Network.

MR G.C. KELLY: Protected Natural Areas Working Party; Scientific Committee, Marlborough Sounds Maritime Park Board; Technical Advisory Group, Biological Resources Centre.

DR M.S. MCGLONE: INS Radiocarbon Advisory Committee; NZ Ecological Society Newsletter editor; *N.Z. Journal of Botany* Editorial Board; Royal Society of N.Z. Committee for Quaternary Research, Secretary.

DR N.T. MOAR: Moa Swamp Advisory Committee, Queen Elizabeth II National Trust; Royal Society of NZ (Canterbury Branch) representative on Pyramid Valley.

DR B.P.J. MOLLOY: Aorangi National Parks and Reserves Board, Honorary Botanist, Summit Road Society (Canterbury); North Canterbury Catchment

Board; Riccarton Bush Reserve Trustee; South Canterbury Land Settlement Committee; Summit Road Advisory Committee.

DR M.J. PARSONS: Australasian Society for Phycology and Aquatic Botany, Vice-President, 1982-83, President, 1983-; International Phycological Society, Executive Council 1984- and Constitution Revision Committee Nov. 1982 - May 1983.

DR A.D. THOMSON: NZ Genetical Society, Secretary.

DR C.J. WEBB: Marlborough Nassella Tussock Board.

DR P.A. WILLIAMS: Marlborough Land Settlement Committee; North Canterbury Nassella Tussock Board; South Canterbury Catchment Board and Regional Water Board.

STAFF CHANGES

Staff Numbers and Finance

	1981/82	1982/83	1983/84
Permanent Staff Ceiling	53	50	50
Salaries	1,225,000	1,365,800	1,274,300
Other Expenditure	254,600	243,100	420,800
Total Expenditure	1,479,600	1,608,900	1,694,100
Voted	1,403,600	1,659,300	1,688,400

Retirements and Resignations

Dr D.J. Galloway, Scientist from 15.12.72, resigned on 31.3.82.
Mr P.J. Schurink, Technical Trainee from 5.3.79, resigned on 29.7.82.
Dr H.E. Connor, Director, from 12.2.40, retired on 4.8.82.
Miss J.F. Dodson, Technical Trainee from 30.1.78, resigned on 3.9.82.
Mr A.P. Druce, Scientist from 1.4.58, retired on 14.12.82.
Miss J.B. Ulrich, Technician from 12.11.80, resigned on 12.3.83.
Mrs R.W. Hough (nee Amer), Typist from 13.4.76, resigned on 30.4.83.
Miss R.H. Conway, Botanical Artist from 19.12.79, resigned on 22.8.83.
Mrs L.M. Williams, Typist from 18.7.77, resigned on 30.1.84.
Mr A.M. Purves, Technical Trainee from 30.1.78, resigned on 22.2.84.
Dr E.J. Godley, Scientist from 6.1.58, retired on 10.5.84.
Mr R.W.J. Knox, Librarian from 13.10.80, resigned on 22.6.84.
Miss J.B. Francis, Technical Trainee from 16.2.81, resigned on 29.6.84.
Mrs B.V. Paterson, Administration Officer from 1.1.80, resigned on 24.11.84.

Staff Replacements

Dr N.M.U. Clunie	17. 3.82	Scientist	(vice Dr G.N. Park)
Miss H.M. Thomas	19. 4.82	Typist	(vice Miss E.M. Souquet)
Dr W. Harris	9. 8.82	Director	(vice Dr H.E. Connor)
Mrs S.L. Kelly	25.10.83	Senior Typist	(vice Mrs R.W. Hough)
Miss A.J. Campbell	1. 2.84	Typist	(vice Mrs R.W. Hough)
Mr G.S. Burnard	7. 2.84	Admin. Officer	(vice Mrs B.V. Paterson)
Miss V.E. New	5.3.84	Illustrator	(vice Miss R.H. Conway)
Mrs M.D. Stolp	14.7.84	Science Technician	(vice Miss J.B. Francis)
Ms P.A. Brooke	16.7.84	Illustrator	(vice Miss A.M. Hodgins)

New Positions

Mr R.P. Buxton	27. 4.82	Science Technician

Miss S.J. Gamble	28.11.83	Advisory Officer
Dr C.D. Meurk	1.11.84	Scientist

Transfers

Miss E.M. Souquet, Typist, to Department of Education on 22.1.82.
Mrs M.L. Scott, Science Technician, to Plant Diseases Division on 1.10.82.

Temporary Appointments

Miss A.J. Campbell (Typist) from 3.5.82 to 31.1.84.
Mr H.D. Wilson (Scientist) from 5.1.83 to 31.3.83.
Miss A. Ferguson (Typist) from 7.2.83 to 11.8.83.
Mrs B.R. Clarkson (Science Technician) from 9.8.83 to 7.11.84.
Ms P.A. Brooke (Illustrator) from 30.9.83 to 11.6.84.

Special Categories

Mrs P.C.M. Douglass	Leave Without Pay (Overseas) 2.7.81 to 27.2.82.
Dr P.J. Garnock-Jones	Overseas Study Award 8.9.81 to 2.12.82.
Dr M.J. Parsons	Overseas Study Award 12.1.82 to 12.1.83.
Miss J.B.Ulrich	Leave Without Pay (Overseas) 12.3.82 to 12.1.83.
Mrs R.W. Hough	Maternity Leave 30.4.82 to 30.4.83.
Mrs L.M. Williams	Maternity Leave 26.1.83 to 26.1.84.
Mr G.Y. Walls	Leave Without Pay (Overseas) 30.6.83 to 30.9.84.
Mrs B.V. Paterson	Maternity Leave 23.12.83 to 23.12.84.
Dr W.G. Lee	Overseas Study Award 23.3.84 —
Miss A.M. Hodgins	Leave Without Pay (Overseas) 19.4.84 —

Wage Workers

Mrs J.Y.A. Archer	Laboratory Attendant	1. 8.72 — 12. 3.82.
Mr W.R. Carter	Gardener	29. 3.76 —
Mrs M.D. Stolp	Laboratory Attendant	18.10.76 — 13. 7.84.
Mr R. Mudgway	Gardener	19. 1.78 —
Mr A. Dodds	Gardener	2.10.79 —
Ms P.A. Brooke	Field Hand	3. 5.82 — 30. 9.83.
Mrs A.F. Watkins	Laboratory Attendant	26. 8.82 —
Mrs B.A. Harte	Field Hand	5. 9.83 — 23.12.84.
Dr J. Beever	Field Hand	17.10.83 — 30. 3.84.
Miss H.M. Clark	Laboratory Attendant	25.10.83 — 25.11.84.
Miss J.S. Irwin	Laboratory Attendant	31.10.83 — 24. 2.84.
Mrs D.H. Percy (nee Smith)	Laboratory Attendant	2.11.83 — 9. 5.84. 4.11.84 —
Mrs R.W. Hough (nee Amer)	Typist	5.12.83 — 26.10.84.
Miss D. Fuller	Gardener	5.12.83 — 30. 3.84.
Mr A.M. Atkinson	Gardener	5.12.83 — 10. 2.84.
Mrs G.B. Clark	Technical Assistant	4. 1.84 — 30. 3.84.
Miss M. O'Callaghan	Laboratory Assistant	4. 1.84 — 27. 1.84.
Miss P.W. Lovis	Laboratory Assistant	30. 1.84 — 14. 2.84.
Mrs A.L. Grew	Laboratory Attendant	7. 2.84 — 4. 4.84.
Mr R.N. Philipson	Laboratory Attendant	15. 2.84 — 16. 3.84.
Miss P.S. Paton	Laboratory Attendant	23. 2.84 — 12. 3.84.
Mr E.D.W. Freeman	Laboratory Attendant	9. 7.84 —
Miss T.A. Williams	Technical Assistant	17. 7.84 —
Mr A.M.L. Brice	Laboratory Attendant	24. 9.84 — 21.12.84.
Miss L. Hutton	Technical Assistant	4.11.84 —

Contracts

Miss C.M. Brown, NZ Lottery Board — funded position for one year from 29.10.84, to prepare a Guide to Threatened Plants of NZ.

Miss L.J. Mather, Noxious Plant Council Contract for one year from 1.4.84, to study Spanish heath.

Mr N.J. Taylor, Noxious Plant Council Contract for three years from 14.5.84, to study nassella tussock.

Ms C.J. West, Noxious Plant Council Contract for three years from 10.9.84, to study *Clematis vitalba*.

Vacation Workers

F. Thompson (F)	25.10.81 — 26. 2.82.
D.W. Freeman (M)	9.11.81 — 12. 2.82.
M.C. Christey (F)	16.11.81 — 5. 2.82.
J.R. McClimont (F)	25.11.81 — 12. 2.82.
A.M. Snowball (F)	23.11.81 — 26. 3.82.
K.L. Freeman (F)	5. 1.82 — 19. 2.82.
J.M. Hilton (F)	7. 1.82 — 12. 2.82.
M. Atkinson (F)	11. 1.82 — 26. 3.82.
P.A. Boocock (F)	15. 1.82 — 26. 3.82.
P.E. Westcot (F)	25. 1.82 — 26. 3.82.
G.F. Calvert (F)	26. 1.82 — 19. 2.82.
V.J. Prickett (F)	3. 2.82 — 26. 2.82.
G. Ward (F)	8. 2.82 — 12. 3.82.
Y.N. Safi (F)	8. 2.82 — 26. 2.82.
H.M. Kuok (M)	19. 2.82 — 26. 2.82.
S. Lau (M)	19. 2.82 — 26. 2.82.
T.K. Leone (M)	19. 2.82 — 26. 2.82.
A. Tia (M)	19. 2.82 — 26. 2.82.
G.M. Rogers (M)	22. 2.82 — 26. 3.82.
A.R. Gardiner (F)	7.11.83 — 24. 1.84.
A.M. Pillai (F)	14.11.83 — 30.12.83.
N.K.M. Chin (M)	14.11.83 — 30.12.83.
F.J. Laing (F)	17.11.83 — 27. 1.84.
	19.11.84 —
P.M. Lovis (F)	21.11.83 — 27. 1.84.
M.O'Callaghan (F)	21.11.83 — 30.12.83.
A.G. Boereboom (F)	21.11.83 — 17. 2.84.
M.C. Compton (M)	21.11.83 — 24. 2.84.
	22.11.84 —
P.J. de Lange (M)	21.11.83 — 24. 2.84.
	21.11.84 —
P.E. Johnson (F)	5.12.83 — 1. 2.84.
M. Horlor (F)	12.12.83 — 24. 2.84.
S.J. Roundhill (F)	12.12.83 — 17. 2.84.
	5.11.84 —
J.D. Galilee (M)	12.12.83 — 27. 1.84.
S.V. Hall (F)	19.12.83 — 27. 1.84.
P.R. van Gardingen (M)	4. 1.84 — 31. 1.84.
S. Clegg (F)	31. 1.84 — 30. 3.84.

D.J. Lovegrove (M)	3. 2.84 — 23. 2.84.	
H.M. Chapman (F)	29.10.84 —	
N.A. McDonald (F)	12.11.84 —	
M.D. Hern (M)	19.11.84 —	
M.L. Crofts (F)	19.11.84 —	
A.D. Walker (F)	21.11.84 —	
R.D. Langley (M)	21.11.84 —	
I.J. McMeeking (F)	21.11.84 —	
D.K. Manning (F)	26.11.84 —	
F.A. Maxwell (F)	26.11.84 —	
S.A. McLennan (M)	26.11.84 —	

Project Employment Programme

F. Lester	26. 4.82 — 26.10.82	Catalogue records in the Library.
J.M. Slow	17. 5.82 — 17.11.82	Reorganisation of the Grass Herbarium collection.
A.S. Dawson	5. 7.82 — 5. 1.83	Proof reading the "Flora of New Zealand Lichens" text.
A.M.B. Miles	13. 7.82 — 5. 1.83	Proof reading the "Flora of New Zealand Lichens" text.
P. Rutledge	5. 1.83 — 5. 7.83	Reorganisation of the Grass Herbarium collection.
B.J. Harte	24. 1.83 — 22. 7.83	To write summaries for 300 reports on New Zealand vegetation, and to classify and index the reports.
C.A. Williams	31. 3.83 — 25. 5.83	Draft a new Botany Division file index; renumber all current files and rehouse in new shelving; compile a cross-reference to all closed files.
D.A. Cross	14. 2.83 — 14. 8.83	Reorganise the order of the Pacific collections of specimens and extract sets of duplicate specimens for exchange with other Herbaria. Involves mounting, relabelling and sorting specimens.
R.M.A. Macmillan	21. 2.83 — 19. 8.83	Reorganise the order of the Pacific collections of specimens and extract sets of duplicate specimens for exchange with other Herbaria. Involves mounting, relabelling and sorting specimens.
F.A. Maguire	21. 2.83 — 21. 9.83	Assembling data in a standardized format for computer storage, from a backlog of 400,000 herbarium sheets. Sort

		specimens according to certain criteria, look up grid references and other information, then collate in standard way.
D.F. Fraser	7. 3.83 — 7. 9.83	Update the Herbarium's duplicate collection of specimens.
D. Findlay	26. 4.83 — 26.10.83	To compile a listing of current research projects and disseminate in popular form, information on the Division's work, to the public.
G.B. Clark	27. 6.83 — 23.12.83	Proof read computer printouts of text of Flora of New Zealand Volume 9 (Desmids); Proof read alterations to text of Volume 4 (Lichens) and insert marks for SIPC; check index marking and collate text for the four authors of Volume 5 (Naturalised Dictoyledons).
M.A. Genet	27. 6.83 — 10.10.83	Proof read computer printouts of text of Flora of New Zealand Volume 9 (Desmids); Proof read alterations to text of Volume 4 (Lichens) and insert marks for SIPC; check index marking and collate text for the four authors of Volume 5 (Naturalised Dictoyledons).
M.C. Cox	29. 6.83 — 2. 9.83	The reorganisation and transfer of pollen data to computer storage.
S.E. Laing	5. 9.83 — 2. 3.84	Complete the reorganisation of the Library catalogue.
L.H. Francis	12. 9.83 — 12. 3.84	To prepare information collected by Botany Division ecologists as a national inventory of vegetation of coastal dunes and beaches.
D.F. Overend	14. 9.83 — 14. 3.84	To develop variants of the Marlborough Daisy (*Pachystegia*) for horticultural purposes, to a stage when propagating material can be released to nurserymen for propagation and sale.
H.M. Jewitt	29. 9.83 — 23. 1.84	The reorganisation and transfer of pollen data to computer storage.
J.L. West	26. 9.83 — 14.10.83	To annotate and cross-index on computer, Botany Division's slide collection.

M.E. Taylor	4.11.83 — 30.12.83	Marking up and proof reading the Flora text.
M.J. McQuillan	8.11.83 — 17. 4.84	To annotate and cross-index on computer, Botany Division's slide collection.
P.J. Clark	18. 1.84 — 1. 8.84	The reorganisation of the Grass Herbarium collection.
M.E. Taylor	19. 3.84 — 18. 9.84	To assist with the amalgamation of foreign and native sections of the bryophyte herbarium, into single evolutionary order.
M.Y. Morris	11. 6.84 — 20.12.84	Checking plant identification keys for technical accuracy and comprehension, against specimens in the Herbarium.
B.L. Stolp	6. 8.84 — 5.12.84	Reorganisation of the Grass Herbarium collection.
G.L. Ashby	6. 8.84 —	Assembling data in a standardised format for computer storage, from a backlog of 400,000 herbarium sheets. Sort specimens according to certain criteria, look up grid references and other information, then collate in standard way.
G.F. Bowis	16. 8.84 —	Systematic check of all books in the Library.
K.L. Rooks	3. 9.84 —	To file Pacific Island collections which are presently stored in boxes separately.

Special Employment Scheme

Angela Snowball	Jul-Oct 1982	Checking and typing data on to computer for checklists of the freshwater algae and diatoms of NZ — (Dr U.V. Cassie-Cooper).
Corry Regnier	Sep 83 — Aug 84	Gisborne Land District Reserves Survey (Dr B.D. Clarkson).
Sarah Beadel, David King and Nick Miller	Sep 83 — Dec 84	South Auckland Land District Reserves Survey (Dr B.D. Clarkson).
Elaine Marshall	Oct 83 —	Compilation of information for PNA rapid inventory survey of western Northland; assistance on surveys requested by Lands and Survey; botanical surveys of scenic reserves in Whangarei County (Dr N.M.U. Clunie).
Sophie Whittebroek	Nov 83 — Jun 84	Assistance on surveys requested by Lands and Survey; botanical

		surveys of scenic reserves in Whangarei County (Dr N.M.U. Clunie).
Jenny Edwards and John Dyer	Nov 83 — Feb 84	Botanical surveys of scenic reserves in Whangarei County (Dr N.M.U. Clunie).

STAFF LIST 1928-1984

(S.J. Gamble)

This list updates the list prepared by E.J. Godley in the 1976-78 Triennial Report

SCIENTISTS AND TECHNICIANS

H.H. Allan	1928-48
V.D. Zotov	1928-68
C.E. Woodhead	1931-36
A.E.W. Reed	1934-35
I.W. Davey	1936-45
A.L. Poole	1937-50
D. Cairns	1938-44
Lucy Moore	1938-71
Ruth Mason	1939-74
I.A. McNeur	1940-41
	1947-50
	1952-53
W.R. Boyce	1940-55
Miriel Sinclair	1940-41
A.J. Healy	1941-46
	1949-77
H.E. Connor	1941-82
Lai-yung Li	1942-42
W.F. Harris	1944-55
Barbara Harman	1945-46
Doris Filmer	1945-48
R. Dun	1945-48
Sheila Boyce	1945-50
B.G. Hamilton	1945-54
T.W. Rawson	1945-75
J.G. Gibbs	1947-49
Audrey Cook	1947-54
A.P. Druce	1947-54
	1958-82
J.B. Hair	1947-74
N.T. Moar	1947-
M.E. Roberts	1948-50
Philippa Barker	1948-51
M.H. Bannister	1948-52
A.H. Amos	1949-50?
Joyce Sansom 1	1949-50
Helen Clark	1949-51
Gertrude Roberts	1949-50
Margaret Bulfin	1950-
H. Penhall	1951-51
C.M. Smith	1951-57
C. Kundycki	1951-55
R.V. Mirams	1952-53
Rasma Licitis	1954-55
Margot Forde	1954-59
E.J. Beuzenberg	1954-
A.A. Sutherland	1955-64
Bryony Macmillan	1955-
Judith Harrison	1954-62
B.M. Gilpin	1957-64
Judith Hay	?
Pauline Harrigan	?
E.J. Godley	1958-84
I.A.E. Atkinson	1958-
F.J.F. Fisher	1958-65
J.E. Herkert	1959-61
Elizabeth Edgar	1959-
P. Wardle	1960-
A.H. MacRae	1960-66
W.R. Sykes	1961-
R. Melville 2	1961-62
Jane Taylor 3	1961-63
G.C. Jackson	1962-62
	1967-70
I.R. Fryer	1963-65
Karina Jansen	1963-63

Ann Latter	1963-64
Frances McNish	1963-64
Jean Clarke	1963-69
Ann Quigley	1964-64
Judith Pawsey	1964-65
B.E.V. Parham	1964-71
Eileen Wilson	1964-65
W.D. Burke	1964-65
Alison Watkins	1964-70
	1982-
Barbara Groves	1964-74
S.L. Kircher	1965-67
G.C. Kelly	1965-
J.V. Myers	1965-
D.R. Given	1965-
Kathy O'Neill	1966-68
E.J. Braybrooke	1966-66
J.M. Mawson	1967-67
D.G. Drury	1967-74
H.J. Armstrong	1967-68
Melva Philipson	1967-
A.W. Purdie	1967-
Diane Percy	1968-81
	1983-
A.R. Mitchell	1968-70
A.E. Esler	1969-
Diana Kelly	1969-75
M.K. Reynolds	1969-
P.H. Raven 4	1969-70
Elizabeth Rivers	1969-71
B.P.J. Molloy	1969-
G.B. Knight	1970-70
Mary Chapman	1970-74
Sandra Astridge	1970-75
Linda Stemmer	1970-76
M.J. Parsons	1971-
A.D. Campbell	1971-80
A.D. Thomson	1971-
M.S. McGlone	1972-
D.J. Galloway	1972-82
Mary Kalin-Arroyo 5	1973-74
J.C.E. Hubbard	1973-75
P.N. Johnson	1973-
Dorothy Hancock	1974-74
S.R. June	1974-78
Pauline Douglass	1974-
Pru Newton	1974-77
D.J. Court	1974-75
R.N. Patel	1974-
R.D. Wood 5	1975-76
G.N. Park	1975-81
P.J. Garnock-Jones	1975-
C.J. Webb	1975-
G.Y. Walls	1975-
Barbara Matthews	1975-81
P.A. Williams	1975-
R.B. Allen	1975-
Shirley Bowman	1975-77
Julie Shand	1975-
Vivienne Cassie-Cooper	1975-
Mary Stolp	1976-
W.G. Lee	1976-
Debbie Beetham	1976-81
Kalesi Vakaloloma	1976-77
Lynne Scott	1977-82
Katrina Stewart	1978-
A.M. Purves	1978-84
J.F. Dodson	1978-82
P.J. Schurink	1979-82
Janie Glasson	1980-
Mary-Ann Bloomfield	1980-
Jan Ulrich	1980-83
T.R. Partridge	1981-
Jillian Francis	1981-84
B.D. Clarkson	1981-
M.I. Dawson	1981-
N.M.U. Clunie	1982-
W. Harris	1982-
R.P. Buxton	1982-
A.J. Fife 6	1982-
C.D. Meurk	1984-
Louise Mather 7	1984-
N.J. Taylor 7	1984-
Carol West 7	1984-
Catherine Brown 8	1984-

BOTANICAL ARTISTS

Nancy Adams	1943-59
K.R. West	1959-79
Yvonne Orpwood	(Part Time)
Jenny Anderson	(Part Time)
Dorenda Birtten	(Part Time)
Beverley McCulloch	1969-73
Victoria Vendetti	1973-74
Judith Mulholland	1974-75
Jenny Watson	1975-75
Gabrielle van Bree	1975-76
Robyn Conway	1976-83
J.M. Cawley	1980-81

Anne Hodgins	1981-
Vicky New	1984-
Pat Brooke	1984-

LIBRARY

Ruth Leatham	1949-49
Helen Drummond	1954-55
Patricia Davie	1955-55
Anne Lucas	1955-56
Joan Jackson	1956-57
Ann Somers	1957-59
Mollie Blackmore	1960-80
Barbara Harris	1959-66
Robyn Bell	1966-70
Ann Leask	1970-73
Sue Griffin	1973-76
Lynley Nesbitt	1974-
Brenda Smith	1976-80
R.W.J. Knox	1980-84
Jan Taylor	1980-

EXPERIMENTAL GARDENS

J. Swindlehurst (Moutoa)	
G. Briggs (Waiwhetu)	
R.R. Briggs (Waiwhetu)	
J.L. Dryden (Waiwhetu)	
B.L. Nicholls* (Lincoln)	1956-60
I.C. Brown* (Lincoln)	1958-
E. White	
W.J. Fuller	
C. Arps	
P.E. Page	
I. Tiplady	
H.J.F. Pratt	
W. Broomhall	
Jean Clarke	
C.H. Fletcher	
G.F. Heasley	
C.R. Hogan	
R.A.J. Marcon	
R.W. Smith	
D.J. Purcell	1979-
A. Dodds	1979-
K. Barlow	
P. Barlow	
E.J. Purcell	
Dorothy Smith	
A.J. Smith	
R. Smith	
G.F. Neill	
K.R. Pengelly	
G.W. Manson	
A. Taylor	
E.V. Watson	
J. Keenan	
D. Simpson	
M.A. Guthrie	
Betty Happer	
R.J. Dunn	
W.R. Carter	1976-
Judith Worthington	1977-79
R. Mudgway	1978-
M. de Goldi	

OFFICE

Patricia Healy	1937-45
Agnes Hutson	1948-54
Gwen Roberts	
Mollie Cassidy	
R.J.L. Sheehy#	1954-61
Margaret Syddall	1954-59
Marilyn Jackman	1959-62
V.F. Pennington#	1962-66
Heather Birch	1962-63
Dorothy Pennington	1963-64
Pamela Knox	1964-65
Abigail Davidson	1965-72
J. Thoms#	1966-75
L.J. Cooper	1967-78
Vera Gilmour	1971-72
Mona Jones	1972-73
Shirley Townshend	1972-73
Margaret Richardson	1973-73
Gilian Carnielo	1973-74
Ann Olsson	1973-76
Pat Farrington	1974-76
J.A. Coleman#	1975-80
Jill Burton	1976-76
Rosemary Amer	1976-82
	1983-84
Helen Greatrex	1977-77
Lila Williams	1977-84
S.J. Dalley	1980-80
Barbara Paterson#	1980-84
Karen Sloan	1980-

E.M. Souquet	1981-82	Sherryn Kelly	1983-
Janice Stenning	1981-	Alison Campbell	1982-
Helen Thomas	1982-	G.S. Burnard#	1984-
Susan Gamble+	1983-		

* Officer-in-Charge
\# Administration Officer
\+ Advisory Officer
1 Goldsmith's Scholar
2 DSIR Senior Research Fellow
3 DSIR National Research Fellow
4 Senior Postdoctoral Fellow, National Research Advisory Council
5 Visiting Research Fellow
6 Postdoctoral Fellow, National Research Advisory Council
7 Noxious Plants Council Contract
8 NZ Lottery Board funded position

PUBLICATIONS

(Compiled by S.J. Gamble)

TAXONOMY OF TRACHEOPHYTA

Edgar, E.; Connor, H.E. 1982: *Dichelachne* (Gramineae) in New Zealand. *N.Z. Journal of Botany 20*: 303-309.

——1983: Nomina Nova III, 1977-1982. *N.Z. Journal of Botany 21*: 421-441.

Druce, A.P.; Given, D.R. 1984: New combinations in New Zealand *Crassula* (Crassulaceae). *N.Z. Journal of Botany 22*: 583.

Garnock-Jones, P.J. 1981: Change of adaptations from entomophily to autogamy in *Parahebe linifolia* (Scrophulariaceae). *Plant Systematics and Evolution 137*: 195-201.

——1983: Proposal to reject the name *Epilobium junceum* Spreng. (Onagraceae). *Taxon 22*: 656-658.

——1984: *Ceratocephalus pungens* (Ranunculaceae): a new species from New Zealand. *N.Z. Journal of Botany 22*: 135-137.

——1984: Fumitories in Canterbury. *Canterbury Botanical Society Journal 28*: 35-38.

Garnock-Jones, P.J.; Molloy, B.P.J. 1982: Polymorphism and the taxonomic status of the *Hebe amplexicaulis* complex (Scrophulariaceae). *N.Z. Journal of Botany 20*: 391-399.

Given, D.R. 1982: Checklist of dicotyledons naturalised in New Zealand. 13. Rosaceae. *N.Z. Journal of Botany 20*: 381-385.

——1982: Records of *Sticherus flabellatus* (R. Br.) H. St. John (Pteridophyta — Gleicheniaceae) from South Island, New Zealand. *N.Z. Journal of Botany 20*: 381-385.

——1984: A taxonomic revision of *Celmisia* subgenus Pelliculatae section Petiolatae. *N.Z. Journal of Botany 22*: 139-158.

——1984: Checklist of dicotyledons naturalised in New Zealand. 16. Compositae — tribes Veronieae, Eupatorieae, Astereae, Inuleae,

Heliantheae, Tageteae, Calenduleae, Arctoteae. *N.Z. Journal of Botany 22*: 183-190.

——1984: Checklist of dicotyledons in New Zealand. 18. Crassulaceae, Escalloniaceae, Philadelphaceaea, Grossulariaceae, Limnanthaceae. *N.Z. Journal of Botany 22*: 191-194.

Given, D.R.; Markham, K.R.; Moore, N.A. 1983: A phytochemical reappraisal of the taxonomic subdivisions of *Lycopodium* (Pteridophyta — Lycopodiaceae). *N.Z. Journal of Botany 21*: 113-120.

Lee, W.G.; Given, D.R. 1984: *Celmisia spedenii* G. Simpson, an ultramafic endemic, and *Celmisia markii*, sp. nov., from southern New Zealand. *N.Z. Journal of Botany 22*: 585-592.

Macmillan, B.H. 1983: *Acaena profundeincisa* (Bitter) B.H. Macmillan comb. nov. (Rosaceae) of New Zealand. *N.Z. Journal of Botany 21*: 347-352.

Molloy, B.P.J. 1982: New names for conifers and a checklist of species and wild hybrids. *Canterbury Botanical Society Journal 16*: 9-11.

Molloy, B.P.J.; Johns, J.H.G. 1983: *Chiloglottis gunnii* Lindley, a new orchid record for New Zealand. *The Orchadian 7*: 210-214.

Pauptit, R.A.; Waters, J.M.; Rowan, D.D.; Russell, G.B.; Connor, H.E.; Purdie, A.W. 1984: The structure of 19 H-Lupeol methyl ether from *Chionochloa bromoides. Australian Journal of Chemistry 37*: 1341-1347.

Philipson, M.N.; Philipson, W.R. 1982: A preliminary synopsis of the genus *Rhododendron* III. *Notes of the Royal Botanic Garden, Edinburgh 14*: 225-228.

Purdie, A.W. 1984: Some flavonoid components of *Carmichaelia* (Papilionaceae) — a chemotaxonomic survey. *N.Z. Journal of Botany 22*: 7-14.

Sykes, W.R. 1982: Checklist of dicotyledons naturalised in New Zealand. 12. Haloragales, Myrtales, Proteales, Theales, Vioales (excluding Violaceae). *N.Z. Journal of Botany 20*: 73-80.

——1982: Checklist of dicotyledons naturalised in New Zealand. 14. Chenopodiales and Polygonales. *N.Z. Journal of Botany 20*: 325-331.

——1982: Checklist of dicotyledons naturalised in New Zealand. 15. Annonales, Berberidales, Cactales, Fagales, some Geraniales, Juglandales, Laurales, Rutales, Salicales, Sapindales, Tiliales, Nyctaginaceae, and Zygophyllaceae. *N.Z. Journal of Botany 20*: 333-341.

Webb, C.J. 1982: Hydrocotyles in your garden. *Journal of the Canterbury Botanical Society 16*: 68-72.

——1982: Tree lucerne: its taxonomic status and naturalisation in New Zealand. *In*: Logan, L.A. *ed.* "Tree Lucerne in New Zealand." Workshop Proceedings, Crop Research Division, DSIR, Christchurch. Pp. 2-5.

——1984: The correct name for our commonest lawn *Hydrocotyle. Journal of the Canterbury Botanical Society 18*: 70-71.

——1984: How to identify mallows naturalised in Canterbury. *Journal of the Canterbury Botanical Society 18*: 52-57.

Webb, C.J.; Druce, A.P. 1984: A natural intergeneric hybrid, *Aciphylla squarrosa* X *Gingidia montana*, and the frequency of hybrids among other New Zealand Umbelliferae. *N.Z. Journal of Botany 22*: 403-411.

Webb, C.J.; Johnson, P.N. 1982: *Hydrocotyle* (Umbelliferae) in New Zealand: the 3-foliate species. *N.Z. Journal of Botany 20*: 163-168.

Wilson, H.D.; Garnock-Jones, P.J. 1983: Taxonomic notes on Stewart Island

Ranunculus, including two new species. *N.Z. Journal of Botany 21*:341-345.

REPRODUCTIVE BIOLOGY

Bawa, K.S.; Webb, C.J. 1983: Floral variation and sexual differentiation in *Muntingia calabura* (Elaeocarpaceae), a species with hermaphrodite flowers. *Evolution 27*: 1271-1282.

Bawa, K.S.; Webb, C.J. 1984: Flower, fruit and seed abortion: implications for the evolution of paternal and maternal reproductive patterns. *American Journal of Botany 17*: 736-751.

Bawa, K.S.; Webb, C.J.; Tuttle, A.F. 1982: The adaptive significance of monecism in *Cnidoscolus urens* (L.) Arthur (Euphorbiacece). *Botanical Journal of the Linnean Society 85*: 213-223.

Garnock-Jones, P.J.; Molloy, B.P.J. 1982: Protandry and inbreeding depression in the *Hebe amplexicaulis* (Scrophulariaceae). *N.Z. Journal of Botany 20*: 401-404.

Godley, E.J. 1982: Breeding systems in New Zealand plants. 6. *Gentiana antarctica* and *G. antipoda*. *N.Z. Journal of Botany 20*: 405-420.

Webb, C.J. 1981: Andromonecism, protandry and sexual selection in Umbelliferae. *N.Z. Journal of Botany 19*: 335-338.

____1984: Flower and fruit movements in *Muntingia calabura*: a possible mechanism for avoidance of pollinator-disperser interference. *Biotropica 16*: 37-42.

____1984: Pollination specialization and protogyny in *Myrrhidendron donnellsmithii* (Umbelliferae). *Systematic Botany 9*: 240-246.

____1984: Heterophylly in *Eryngium vesiculosum* (Umbelliferae). *N.Z. Journal of Botany 22*: 29-33.

____1984: Constraints on the evolution of plant breeding systems and their relevance to systematics. *In*: Grant, W.F. *ed*. "Plant Biosystematics." Academic Press, Canada, Don Mills, Ontario. Pp. 249-270.

____1984: Hummingbird pollination of *Malvaviscus arboreus* in Costa Rica. *N.Z. Journal of Botany 22*: 575-581.

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UNPUBLISHED REPORTS

(Compiled by S.J. Gamble)

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